THIS MANUAL CONTAINS IMPORTANT CALIBRATION INFORMATION

The following calibration procedures are included at the end of the addendum section in the beginning of this manual.
TC on both channels, 100 ohm RTD's, linear 4-20MA for 0-100% RH and 0 to 5VDC Vaisala Model HMM30C RH sensor.

This and other information provided is not included in manuals printed prior to 4\17\95.

Please take the time to review the addendum section in the front of this manual before continuing.

CAUTION!

DO NOT enter "Calibration" Mode unless or until:

1 - You have read Section 7 on calibration of the unit.

2 - A calibrated input source is connected to the unit.
(Chamber Heat\Cool MUST be disabled during calibration)

3 - You intend to perform a re-calibration.

Failure to follow these steps may result in a loss of factory calibration. It may also cause erroneous process readings.

To verify factory calibration, connect a calibrated input source to the unit, and compare "PV" display to calibrator reading.
This must be done with the Heat\Cool to the chamber disabled.

RH\WB OPERATION

If RH\WB humidity mode is used.

The unit must be calibrated for temperature on both channels. After calibration channel 2 must be returned to RH\WB for correct % RH control and readings.

JC SYSTEMS

ENVIRONMENTAL CHAMBER SYSTEM CONTROLLERS

Complete Single or Dual-Channel Chamber Control System

Simple Front-Panel Calibration, Setup and Operation

JC Systems Quality and Performance

PC-Based Utility Software

Conventional and Thermal Response Accelerating Control Models

Three Year Warranty

The JC Systems family of Environmental Chamber Systems Controllers puts it all together for you: configuration flexibility, ease of operation, convenient packaging plus the dedication to performance, reliability and service you've come to expect from JC Systems – the leader in chamber control innovation.

DUAL CHANNEL PROGRAMMER/CONTROLLER

JC Systems controllers offer the complete solution for temperature, humidity and/or altitude chamber control with two fully independent controller channels plus a 99 program/200 step/16 event setpoint programmer.

Each controller channel is equipped with two sets of dual, independently tuned, event-controlled PID+™ control parameters and dual time-proportioned (heat and cool) outputs. Costly and complex multiple controller configurations can be eliminated and chamber control reconfiguration is as simple as calling up a new program.

Program control is further enhanced with JC Systems' time and energy-saving adaptive soft-start feature and guaranteed soak .

FASTTRAC CONTROL

Thermal Response Accelerating Control (FastTRAC™) is a patented part temperature control technique and a standard feature of the Model 620. FastTRAC control can improve test program throughput performance by 100% or more by rapidly moving the part under test to programmed soak temperatures while simultaneously guarding against potentially damaging levels of thermal stress.

HALF DIN — FULLY JC

The Model 600 and 620 FastTRAC package is industry standard 1/2-DIN in size and meets tough JC standards for ease of installation, setup and operation. Plus you'll find quality design touches like stainless-steel, snap-dome high tactile-feel keypads; long-life LED backlighted LCD displays with adjustable viewing angle; gold-plated, gas-tight connectors; and shock-mounted printed circuit boards.

11535 Sorrento Valley Road, San Diego, CA 92121
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ENVIRONMENTAL CHAMBER SYSTEM CONTROLLERS FROM JC SYSTEMS

The Model 600 and the Model 620 FastTRAC controllers offer you the complete array of performance features that set JC Systems apart as the performance leader in environmental chamber control.

PID+™ CONTROL

The Model 600 and 620 come equipped with two completely independent channels of PID+ control. The *plus* is a proprietary reset clip feature that virtually eliminates setpoint ramp-induced process overshoot while maintaining optimum controllability under step changes in setpoint or load.

Each controller channel provides dual, time-proportioned (heat/cool) outputs, guaranteed soak, high and low process limits and tracking deviation alarms programmable for each step of the setpoint program.

Two linear(4-20mA) outputs are also provided. Each may be assigned to either control channel and each may be used to retransmit the setpoint or process value.

TWO-STAGE PID SETTINGS

Each controller is equipped with a completely independent set of event-initiated PID settings. These "Stage 2" settings can be used to assure optimum performance when the same channel is alternated between humidity and altitude control.

POWERFUL PROGRAMMER

The Model 600 and 620 are equipped with a 200 step/16 event setpoint programmer that can control the operation of either or both controller channels. Use a combination of "Ramp/Soak", "Loop", "Go To", "Go To If" and "Pause" program steps to formulate up to 99 unique process profiles. Each of the 16 event outputs are programmable on each program step.

The *Guaranteed Soak* feature assures that either or both process values are within prescribed limits before a new soak segment begins. And the innovative *Soft-Start* feature reduces both process time and energy costs by taking into account actual chamber temperature whenever the setpoint program is started.

TC, RTD OR LINEAR INPUTS

Every controller comes equipped to handle thermocouple, RTD or linear inputs. Inputs are isolated and transducer linearization and compensation is provided for all standard thermocouples, 100Ω platinum RTDs, wet bulb/dry bulb direct % RH with altitude compensation or linear direct RH%.

Both the Model 600 and 620 feature "from the front panel" input calibration and scaling. Calibration data is stored in non-volatile EEPROM.

COMPUTER COMMUNICATIONS

Built-in, front panel selected and configured RS232 is provided as a standard feature. RS422/485 serial communications is standard on the Model 620 (optional on the Model 600); and, IEEE-488 is also available as an option. Simple front panel commands define baud rate, data structure and address. Then, using simple mnemonic commands, nearly every operation that can be performed from the front panel can also be executed via the computer interface. In addition, under computer command, PID settings can be adjusted "on the fly".

And with JC Systems' utility software package (available at no charge upon request), a pc can be transformed into an environmental chamber control center.

LEDs illuminate whenever a controller output is ON.

The process variable and setpoint for both controllers plus the status of all 16 events are shown in this 2-line LCD display.

The program and step number and time remaining in the step are displayed here.

The operating status (local/remote and run/pause) and any alarm conditions are displayed here.

Simple keystroke operations make fast work of operation, setup and calibration.

MODEL 620 FastTRAC™
THERMAL RESPONSE ACCELERATING CONTROL

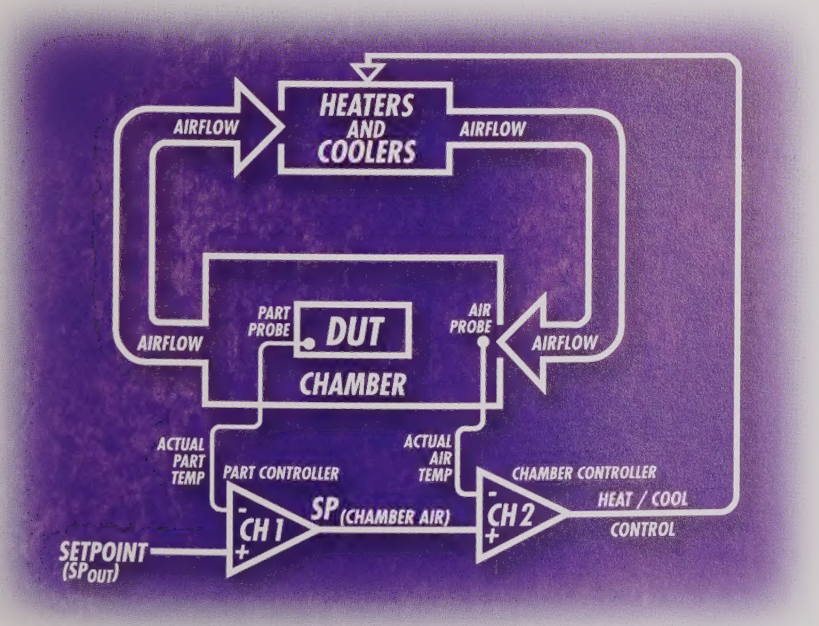
FastTRAC is a patented control technique that offers dramatic improvements in the performance of environmental chamber test program development and execution.

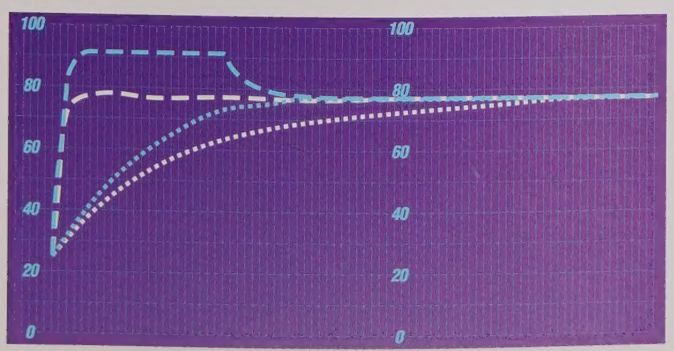
■ With FastTRAC control, there is no need to conduct time-consuming test chamber characterization studies prior to actual device testing.

■ With FastTRAC, the thermal response of the device-under-test will be improved by at least 2:1, so testing will progress at a vastly improved rate.

FastTRAC control combines JC Systems' proprietary ThermoBoost™ technique with an adaptation of classic cascade control to cut DUT thermal response time by 50% or more over conventional techniques while *simultaneously* guarding the DUT against potentially damaging levels of thermal stress.

FastTRAC improves test chamber throughput. Actual part temperature and chamber temperature are monitored so testing can commence immediately after the DUT reaches the specified temperature at each stage of the test program. And since the DUT temperature is carefully controlled, the need for thermal response characterization tests is eliminated.





This chart demonstrates the dramatic improvement in test performance that FastTRAC control provides. In this example, the Device-Under-Test is being heated from ambient to 76C. The dashed lines show the temperature inside the environmental chamber – the white line, under "conventional" control; the blue line under FastTRAC control. The dotted lines, in corresponding colors, show the temperature response of the DUT. Note that while the DUT temperature is well below the new setpoint value, FastTRAC control drives the chamber temperature to the ThermoBoost level of 91C (15 °C above the programmed setpoint). As the DUT actual temperature approaches the programmed setpoint, the chamber temperature is quickly reduced. This results in a better than 2:1 reduction in the time required to bring the DUT to the new soak temperature, without any appreciable overshoot and without any thermal shock to the DUT.

ORDERING INFORMATION

ORDERING EXAMPLE

600 — TC/LIN(1-5V) — I

I — IEEE-488 option.
TC/LIN(1-5V) — Channel 1 configured for thermocouple input; channel 2 for 1 to 5 Vdc input.

Input Type:	(Specify one input type for each controller channel)		
	TC	Thermocouple	Type J, K, T, R, S, B or E. (Unit is configured for type T with -99 to 315 °C range unless specified at time of order.)
	RTD	100Ω Platinum	a =0.00385.
	LIN( )	Linear Input	Signal conditioning network is added for input current (mA) or voltage specified. (Unit is configured for 4-20 mA if not specified.)
Options:		RS-232 Interface	Interface is standard on both the Model 600 and Model 620 FastTRAC.
	4	RS-422/485 Interface	Interface is standard on the Model 620 FastTRAC; specify option for the Model 600.
	I	IEEE-488 Interface	Specify option on either Model 600 or Model 620 FastTRAC.
Accessories:	A2192	Chamber Enhancer (CE)	Heat/cool staging; Compressor time-out (MTO); Bypass output; Independent increase/decrease outputs for second channel.
	A2320	8-Event SSR Board	Provides 8 AC or DC Solid-State Relay control or event outputs.
	A2271	Event/Alarm Relay Board	Provides 10 event output relays and interface to Model 600; up to 4 relays may be assigned to deviation alarm, process limits and MTO (machine time-out).
	A1728	Event Relay Board	Provides 10 additional event relay outputs (7 and 8, A thru H). Model 2271 required.
	A2236	Dual Fast Analog/Dual Sync	Provides dual heat/cool linear control outputs, plus synchronization capability.
	A2298	Single Fast Analog & Sync	Provides analog linear control output plus interface for synchronization.
	M355	Linear Input Adaptor	Converts factory-installed thermocouple input into linear input channel.

SPECIFICATIONS

CONTROLLERS

Inputs: thermocouple inputs: types J, K, R, S, T, B, E; RTD inputs: 100Ω platinum, a = 0.00385; all common mA and mV ranges (e.g. 4-20 mA; 1-5 V as specified at time of order).

Input Ranges: -250 to 1800 °C; -418 to 3272 °F; 0.0 to 100.0 %RH; -418 to 3272 (linear).

Display Resolution: 0.1 units.

Setpoint Resolution: 0.1 units.

Repeatability: ±0.1 units.

Cold Junction Comp: ±0.01 degree/ degree over 15C to 35C ambient.

Calibration Accuracy: ±0.5°C over entire range.

Instrument Accuracy: temperature: ±0.1 °C.
relative humidity: ±1.0% over full range of dry/wet bulb.

Control Functions: dual PID+: two independent, event-selectable sets of control functions for each channel consisting of proportional, integral and derivative control plus reset windup inhibit and reset clipping. "Set 2" tuning is in effect when the enabling event is ON.

cycle time:	2 to 15 seconds.
proportional gain:	0.1 to 999.9.
automatic reset:	0 to 99.99 repeats per minute.
reset windup inhibit:	0 to 100% of prop. band.
reset clipper:	0 to 99% of integral offset.
rate:	0 to 9.9 minutes.
ID band:	0 to 5.5 units.

Manual Mode: selectable, per channel; either manual input of setpoint or manual adjustment of the output level.

Time Proportioning: two per channel (heat & cool); logic outputs suitable for driving photo-isolated solid state relay.

Linear Outputs: two outputs, each assignable to either channel as process variable or setpoint retransmit. 4-20mA or 0-16mA; maximum loop resistance, 600Ω.

SETPOINT PROGRAMMER

Setpoint Range: full range of the controller.

Program Steps: 200 total steps; 99 programs, max.

Step Types: RAMP/SOAK (Standard), EOP (End of Program); LOOP; GOTO; GOTO_IF and PAUSE.

Step Time Duration: 0 to 99:59:59.

Delay Start: 0 to 99:59:59.

Guaranteed Soak: program waits at the end of a ramp step until the process is within specified tolerance; programmable, per step, in 1 unit increments, per channel.

External Events: 16 programmed logic outputs suitable for driving photo-isolated solid state relays.

Process Deviation Alarms: ±1 to 99 units, programmable per channel, per step.

Display Alarm Action: flashing indication on front panel display plus logic output; programmable to clear automatically or to require manual reset.

Programmer Alarm Action: programmable to continue running; or pause until condition clears or until alarm is manually reset.

HI/LO Process Limits: programmable per channel in 1 unit increments over full input range.

Alarm & Limit Outputs: one each per channel, logic output suitable for driving photo-isolated solid state relay.

Control Inputs: external inputs provided for run, stop, reset and front panel lockout.

Program Restart: three power fail recovery modes: Normal (auto resumption of program); Hold (program and setpoint values at time of power fail); Run (selected program and step #).

PHYSICAL CHARACTERISTICS

Overall Dimensions: 6" x 6" x 12 7/8" (w/o accessories); 10 lbs.

Mounting: 5 3/8" square cutout.

Power Requirements: 117VAC ±10%; 25W.

Operating Temperature: 0 to 40C; 85% max. RH, non-condensing.

Numeric Displays: two 2-line, 20 character per line, LED backlighted LCD

MODEL 620 FASTTRAC
FASTTRAC STD. & PASSTHRU OPERATING MODES

FastTRAC STD. MODE:

The FastTRAC Std. mode uses two channels to control chamber operation. The Primary Loop, CH1, is a direct digital PID controller that is used to control the actual part temperature or the area surrounding the part. It reads the actual temperature of the device or the area surrounding it from an RTD or thermocouple, compares this input with the desired setpoint, and generates the chamber air temperature setpoint for CH2, the Secondary Loop, via the programmer.

ThermoBoost:

The ThermoBoost feature is only used in the FastTRAC Std. mode of operation. A selectable ThermoBoost value for the primary controller specifies the maximum allowable difference between the part temperature setpoint and the air temperature setpoint called for by the primary controller. This feature makes it possible to accelerate DUT temperature changes while insuring that the device is not damaged by extreme temperatures.

Independent Heat and Cool ThermoBoost values can be selected for each step of a profile, or in the manual controller mode. A ThermoBoost value of 0 will direct the unmodified Channel 1 setpoint to the Channel 2 air temperature controller.

FastTRAC STD. MODE HI/LO TEMP LIMITS:

Note: The FastTrac HI/LO Limits work only in the Std. Mode.

From the Programmer Configuration Screen if either FastTRAC Std. or FastTRAC PassThru modes are selected, FastTRAC HI/LO Temp limits (for the FastTRAC Std. mode only) may also be entered. The HI/LO limits determine the maximum allowable air temperature setpoint the Ch2 Secondary controller will receive regardless of the programmed setpoint or the ThermoBoost values entered.

DISPLAYS AND INDICATORS FOR FastTRAC STD. OR PASSTHRU OPERATING MODE:

CH1 Setpoint - Primary Loop, Part temp. Setpoint
CH2 Setpoint - Secondary Loop, Air temp. Setpoint
CH1 Process - Primary Loop, DUT or DUT area temperature.
CH2 Process - Secondary Loop, Chamber Air temp.

PassThru MODE:

This mode is entered from the PROGRAMMER CONFIGURATION section.

In the PassThru mode, the CH1 controller setpoint is unmodified and passed directly to CH2. In this case, the unit functions as a single-channel, standard air temperature control system.

In the PassThru mode, if the soft-start feature is enabled and\or the deviation limits are used, they are a function of CH1.
In the PassThru mode the ThermoBoost Values are disabled and the programmed setpoint is passed on to CH2 unmodified.

GUARANTEE SOAK:

The Guarantee Soak feature is enabled for both channels in both FastTRAC STD. or PassThru Modes, and can be used to delay advancing to the next programmed step. When the programmed time of a step reaches 0 and either the Part and, or Air temperatures are not within their selected value, the programmer will wait for that channel's condition to be satisfied before advancing to the next programmed step.

CONNECTING THE CONTROLLER OUTPUTS:

For FastTRAC operation, CH1 Heat/Cool outputs are used.
Connections for the controller outputs are located on the Output Interface Board on the rear of the 620.
The CH2 Heat\Cool control signals are internally redirected to the CH1 outputs. The Ch1 front panel Heat/Cool LED's (arrows) indicate the control action of CH2 the Air Temperature Control.

If the ***Fast Analog*** output is used for Heat or Cool from the Model 620, ***OUTPUT CURRENT LOOP 1*** MUST be assigned to ***CH2***.

SETPOINTS:

Setpoints can only be entered to the Channel 1 controller.

PID TUNING FOR MODEL 620 FastTRAC MODE OF OPERATION:

The channel 2 (secondary) controller MUST be tuned for proper chamber operation as an air temp system prior to attempting to run the system in the FastTRAC STD mode.

Two methods may be used to accomplish this.
1) Run the chamber with the Model 620 in the PassThru mode and tune Ch2 (secondary) for proper chamber operation.
2) Run the chamber in the FastTRAC STD. mode with a ThermoBoost value of 0 for both heat and cool values,and tune Ch2 (secondary) for proper chamber operation.

PRIMARY CONTROLLER CHANNEL 1, STAGE 1			SECONDARY CONTROLLER CHANNEL 2, STAGE 2		
	INC	DEC		INC	DEC
CYCLE TIME:	2	2	CYCLE TIME:	___	___
PROP. BAND:	NA	NA	PROP. BAND:	___	___
PROP. GAIN:	___	___	PROP. GAIN:	___	___
AUTO RESET:	___	___	AUTO RESET:	___	___
RWI %	100	100	RWI %	___	___
RWI UNITS:	NA	NA	RWI UNITS:	___	___
RESET CLIP%	0.0	0.0	RESET CLIP%	___	___
RATE:	0.0	0.0	RATE:	___	___
ID BAND:	0.0	0.0	ID BAND:	___	___

Once the chamber is tuned for proper air temp operation the Ch1 (Primary) controller may be tuned for FastTRAC STD. operation.

PRIMARY (CH 1) CONTROLLER PID SETTINGS:

The Prop. Gain and Auto Reset are the only PID parameter settings used to tune Ch1.
Set all other parameters as noted in the table above.

Prop. Gain: (Determines the rate which the ch2 setpoint changes)

This setting is determined by the Mass of the DUT the sensor is attached to. If the sensor is not attached to the DUT, but monitoring the air surrounding the part, a gain of less then unity is needed. (Try 0.7)
If the sensor is attached to the DUT, presenting a large thermal mass to the sensor, a large gain is needed. (Try 7.0)

Auto Reset: (Determines the magnitude of the ch2 setpoint change)
This setting corrects for the error between the actual temperature (DUT) and the current setpoint. A good starting point is to set the Auto Reset for 1.0.
If the device temperature has not reached the desired setpoint and the Ch2 setpoint is less then the sum of the Ch1 setpoint plus the ThermoBoost value, increase the Auto Reset.
If the DUT temperature exceeds the Ch1 setpoint and the Ch2 setpoint is still equal to the sum of the Ch1 setpoint plus the ThermoBoost value reduce the Auto Reset setting.

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AVOID TURNING AN EOP STEP INTO A LOOP STEP

If a program is entered into a program location that has an existing program, and the new program is shorter then the original one, the first EOP step will be treated as a LOOP step. .

When entering a new program into a location that currently has a program in it, the following procedure must be taken.

ERASE THE EXISTING PROGRAM. - This is the recommended procedure.

From the Edit screen move the cursor so it is flashing on the program (not step) number, then push the DEL STEP button. This will erase the existing program and the display will read "PROGRAM EMPTY, PUSH PAGE DOWN".

Pushing the PAGE DOWN button will insert the first step in the program location. Enter the new program terminating it with an EOP step.

ENTER NEW PROGRAM INFORMATION - This can only be done if the new program has more steps than the existing program. If it does not then the EOP step from the original program will still be present somewhere after the new EOP. The first EOP step will be treated as a LOOP by the programmer when the program is run. The second EOP step will be treated as the true EOP. In this situation the program will cycle (loop) as many times as indicated by the first EOP, however it will be treated as a LOOP Step and continue running the programmed information following the first EOP to include cycling the entire program if the second EOP step is programmed for more then 1 cycle.

CHECKING THE PROGRAM FOR ADDITIONAL STEPS FOLLOWING THE EOP.

In the EDIT Mode pushing the page down button will advance through the program in sequential step order. However if the first EOP step is reached and the PAGE DOWN is pressed the unit will return to step 1 of the program. The first EOP is recognized as the end of the program.
This WILL NOT indicate if any additional steps are following the EOP.

Determine the step for the first EOP in the program (i.e. step 10). From the EDIT screen position move the cursor to the step number and push the clear button. The unit will go to step 1. With the cursor on the step number, enter the number of the step following the first EOP step (step 11).

If this EOP step is the last step in the program, the display will flash between the messages "Invalid Entry" and the Ramp\Soak Program screen.
Push the RESET Button twice to return the unit to the STOP screen. This EOP is the last step.

If the programmer indicates additional programmed steps following this EOP, this information must be deleted. Push the DEL STEP button for each additional programmed step.
Be careful not to delete the EOP step itself. Each time the DEL STEP button is pushed it deletes the current step and pulls the following ones forward. When the correct EOP step is displayed all information that followed it is now deleted.

Check the program for additional steps after the EOP (Just to make sure).

REGAINING LOCAL CONTROL WHEN THE COMPUTER COMMUNICATIONS ARE DISRUPTED, AND THE MODEL 620\600 IS IN THE "RMT_RUN" MODE.

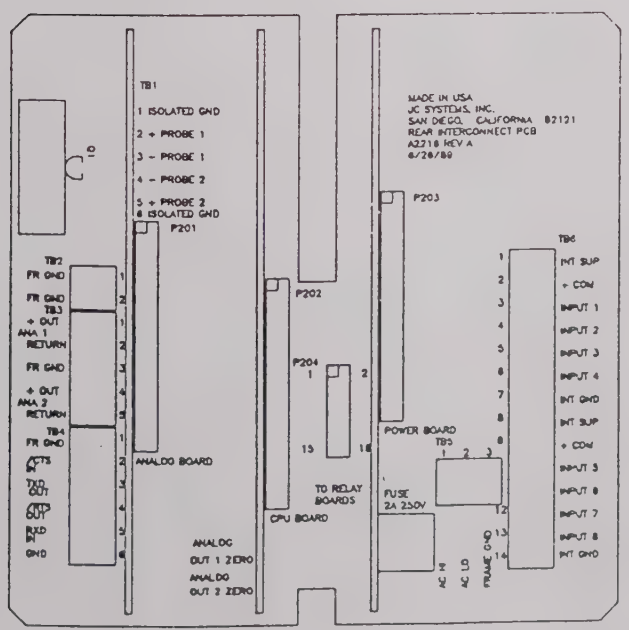
If computer communications are lost while the Model 620\600 is running a program in the Remote (Ext. Computer) mode, the unit must be stopped prior to regaining Local (LCL) mode of operation.

This is accomplished by installing a momentary switch to the input terminal block TB6 as shown below.

Pushing the button will stop the program. However the unit will remain in the RMT mode. To regain Local control follow the sequence below.

Push the **RMT STOP** button.	(Installed on TB6)
Push the <**PAGE DOWN**> button.	(To MAIN MENU)
Push the <**4**> button.	(CONFIG-TUNE-CALIB)
Push the <**1**> button.	(CONFIG.PROGRAMMER)
Push the < V > (**Down Arrow**)	(Moves cursor to MODE: EXT_COMPUTER)
Push the <**SEL**> button.	(Change to MODE: FRONT PANEL)
Push the <**RESET**> button.	(To the standard run screen in LCL mode.)

You are now in the **LCL** (Front Panel) mode of operation. All functions are now accessable from the front panel.



Install a 560 to 680 ohm resistor on TB6 between pins 1 (int sup) and 2 (+ com).

Install the Remote Stop switch (momentary) on TB6 between pins 4 (input 2) and 7 (int gnd).

JC SYSTEMS

P R O D U C T I M P R O V E M E N T N O T I C E

PRODUCT EFFECTED: MODELS 600 and 620 (Firmware Vers 1.17 and later)

CHANGE: Output function of TB1 Pin 8, A2225 Output Interface PCB.
From - Ch2 Deviation Alarm.
To - Compressor Machine Time Out (Ref. as MTO)

The current Firmware Vers. in the unit can be determined by momentarily turning the units power off and on. During initialization of the unit (app 5 sec.) the Model number and Firmware version are displayed on the third line of the front panel display.

In all units with Firmware Vers. prior to 1.17 Ch1 & Ch2 have independent Alarm outputs (TB1-7 & TB1-8 respectively). The appropriate channel's output would be active if either a programmed deviation or a setpoint alarm condition occured on that channel.
(Ref 620 Manual pg. 4-2 Sec. 4.1.3 Respond to Alarms)

In Vers 1.17 or later, both channels share a common output for deviation alarm or setpoint alarm conditions. This output is TB1-7. If either condition exist on either channel the output on TB1-7 will turn on.

The output function of TB1-8 has been redefined as the MTO.
This function is refered to as a "future capability" in the last sentence on pg. 6-5 Sec 6.4.5.

On the third page of the Controller Configuration for Ch1 & Ch2 the prompt reads:

```
COMPRESSOR TIME_OUT     (MTO)
CHX= 0:00 (MIN:SEC)     (X = 1 OR 2)
```

The MTO may be set from 00:00 (off) to a maximum of 59:59 (MIN:SEC). The MTO can be set for either Ch1 or Ch2 independently, or for both channels to operate the output concurrently.

The MTO timer is set and begins it's timeout at the end of each Decrease signal from the controller. This action develops a low output on TB1-8 (MTO on). If Ch1 MTO is set for 2 min. (Ch2 for 00:00) the timer is reset to 2 min. with each Ch1 Decrease pulse. If 2min. passes without a Decrease pulse from Ch1 the output at TB1-8 turns off (output high). Operation is the same for a MTO set on Ch2 and 00:00 on Ch1.

If both Ch1 and Ch2 have a MTO, the timer is restarted by a Decrease pulse from either channel. For example, Ch1 MTO = 2, Ch2 MTO = 4. A decrease pulse from Ch1 starts the 2 min. timer, if a Ch2 decrease pulse occurs during the 2 min., the timer is reset and starts at 4 min.
In most cases both MTO's are set for the same time.

MODEL 620 AND MODEL 600 PROGRAMMER / CONTROLLERS

ADDITIONAL FEATURES:

1. **NEW INPUT TYPES ADDED WITH EXTENDED SETPOINT AND OPERATING RANGES**
   Accessed through CONTROLLER CONFIGURATION CH1 & CH2

   Input types now available:

TYPE THERMOCOUPLE	**RANGE OF OPERATION** DEGREES C	**RANGE OF OPERATION** DEGREES F
T	-250 C to 315 C	-418 F to 599 F
J	-210 C to 760 C	-346 F to 1400 F
K	-250 C to 1260 C	-418 F to 2300 F
R	-50 C to 1500 C	-58 F to 2732 F
S	-50 C to 1500 C	-58 F to 2732 F
E	-190 C to 770 C	-310 F to 1418 F
B	+100 C to 1710 C	+212 F to 3110 F
RTD 100 ohms Alpha = 0.00385	-100 C to 315 C	-148 F to 599 F

TYPE LINEAR	**RANGE OF OPERATION**		
MA (4 - 20MA)*	-999 to +999	or	+999 to -999
VOLTAGE *	-999 to +999	or	+999 to -999

*NOTE: Various linear current and voltage inputs may be used by selecting the appropriate JCS M355 input board.

2. **STORED CALIBRATION PARAMETERS:**
   Accessed through CONTROLLER CALIBRATION CH1 & CH2

   The individual calibration parameters are remembered for each input type configuration after initial calibration.

3. **AUTOMATIC GRADIENT OFFSET COMPENSATION:**
Accessed through CONTROLLER CONFIGURATION CH1 & CH2

Compensation for gradient temperature offset between controller probe location to chamber work space area.

NOTE: A controller channel CANNOT be calibrated if a gradient offset value is presently in use. Prior to any controller calibration you must set the CONTROLR AND CHAMBER settings to equal values for the LOW, MED & HIGH sets (ie. LOW -50 & -50, MED 100 & 100 and HIGH 300 & 300). After calibration is complete the offset values can be reentered.

Setting up the Auto-Gradient compensation is as easy as a b c.

a. Calibrate the controller directly at its inputs using a precision calibrator such as a "Biddle".

b. Reconnect the controller probe from the chamber and install an auxiliary temperature monitor probe in the work space area. Run the system at three different temperatures (Low, Medium and High). Allow the chamber to stabilize at each temperature. Make sure that the controller's setpoint and indicated temperature agree. Record the controller setpoint and the actual temperature as read in the workspace by the auxiliary temperature monitor for all three temperatures.

c. Select the appropriate channels' configuration screen for entry of offset values. Enter the recorded controller setpoint values under "CONTROLR", and the actual monitored workspace values under "CHAMBER".

This action offsets the temperature display and internal setpoint of the controller so as to cause the controller setpoint, temperature display (and computer accessed values) and monitored workspace temperature to all agree.

The gradient offset correction interpolates between the three sets of values.

4. MINIMUM AND MAXIMUM POWER "ON" SETTINGS

Accessed through CONTROLLER PID TUNING on CH1 & CH2

Each channels controller output (both INC & DEC) can now be adjusted to produce a continuous selected percentage of its output power when that channel output function is "OFF". In this manner a Humidity Boiler can be kept warm even though the controller may be calling for DeHumidify action.

Note: You Must NOT utilize this feature if your are using an A2192 Chamber Enhancer board on the channel in question. The minimum power remaining "ON" will prevent the other output mode from ever turning on.

The Maximum "On" Power can be adjusted to limit the maximum power output that can be delivered. The controller output will never exceed this limit.

Each stage of tuning parameters has this capability.

5. SINGLE CHANNEL OPERATION.

Accessed through PROGRAMMER CONFIGURATION

You can configure the 620 or 600 into a SINGLE Channel unit. The program screens only prompt for channel 1 information while programming in the EDIT mode.

You can still utilize the second channel as a monitor and indicate the process value currently at the input of CH2. You can also access the CH2 process values via the computer interface.

While in this configuration, the CH2 setpoint display indicates dashes (---.-).

6. IMMEDIATE VECTOR & EXECUTION OF A SELECTED PROGRAM (initiated by an external input on TB6 pin 8.)

Accessed through PROGRAMMER CONFIGURATION

Upon receipt of this external command the Unit immediately stops it's current activity, jumps to and immediately executes the selected program.

The temperature (humidity etc) is "Soft Started" in that the ramp is started from the current process temperature.

This feature con only be enabled from the front panel.

7. POWER FAIL RECOVERY AUTOMATIC SEQUENCE OF ACTIONS.

Accessed through PROGRAMMER CONFIGURATION

Should the power fail and come back on, the actual difference between the process values before and after the power failure are compared to selectable preset limits.

Separate process trip deviation values may be entered or disabled for each channel.

Three options are available if the preselected limit are exceeded:

A. NORMAL MODE - Recover and resume all operations

B. HOLD CURRENT VALUES - program execution is halted, the current setpoint values for both channels are latched and control the processes at those values. The L1 and L2 alarms are turned on. The operator can then use judgment and determine what he or she wants to do.

C. RUN A PROGRAM - If the process change is greater than the selected trip limit for either or both channels, automatic execution of the preselected program and step of your choice occurs. The step vectored to must be a Standard (Ramp/Soak) step.

   The program execution is automatic and the two process values (dual system) are "Soft Started" from the current process values.

8. SITE ALTITUDE COMPENSATION FOR WB/DB (RH/WB) DIRECT PERCENT RELATIVE HUMIDITY CONFIGURATION.

Accessed through PROGRAMMER CONFIGURATION

The Altitude of the site location where the controller is located can now be entered as part of the programmer configuration. This information is input in feet above sea level.

9. GOTO_IF STEP TYPE ADDED

Programmable Conditional Jump Step Added as a step type in EDIT MODE.

This GOTO_IF step can be selected while programming and allows a jump to any Program (including the current) and step if the condition being tested is true. If the selected test condition is false, the program advances to the next step in sequence.

There are three types of conditions that can be used for branching control:

a. Input #4 ON - an input signal at the remote input TB6 pin 4 when the GOTO_IF step is executed causes the Unit to execute the preselected program and step. If there is no input, the program executes the sequential step.

OR

b. Numbered Events 1,2,3,4,5,6,7 or 8 are used for the condition to check. The selected numbered event turned ON causes the jump.

OR

c. Lettered events A,B,C,D,E,F,G or H are used for the condition to check. The selected lettered event turned ON causes the jump.

You can now make use of the "X" (don't care) selection to allow the events to be used as a "memory flag" for making branching decisions at a later time in the program.

10. DELETE A PROGRAM FROM PROGRAMMER MEMORY:

Accessed in EDIT MODE

To delete an entire program from the Model 620 or 600 memory:

a. Enter the EDIT Mode from the main menu.

b. Select step #1 of the program to be deleted.

c. Move the flashing cursor with the arrow keys over the displayed program number.

d. Depress the DEL STEP key.

The entire selected program will be erased.

11. GUARANTEED SOAK OPERATION -

Accessed in EDIT MODE.

a. Enter the Guaranteed Soak value on the Ramp Step. The Ramp step is the segment in the program in which you are changing temperature.

b. When the time remaining for the step goes to zero, the difference between the current process value and the setpoint is checked.

   If this difference exceeds the Guaranteed Soak Limit the Unit simply waits until the limit is met before going on to execute the next step.

   The previous version of firmware caused the Unit to wait to START the step in which the Guaranteed Soak was programmed. As a consequence, this feature may not have been used by customers using the older version.

12. ADDITIONAL COMPUTER INTERFACE AND VIEW SCREEN INFORMATION AVAILABLE WHILE THE PROGRAM IS RUNNING

This view screen is accessed by depressing the PAGE DOWN button 3 time while a program is running. (The computer commands are: "CTG" (cycles) and "LTG" (loops).

This new run time information screen allows the user to view the number of nested loops remaining and the number of program cycles remaining while the program is running.

The Loops remaining and Cycles remaining will display " ----" if the first pass has not yet been completed. The first pass is included in the number of loops or cycles programmed and the counter is not accessed until the first pass is made.

An example helps to clarify the above: If 10 cycles were entered at the EOP step, a " ----" would be displayed until the unit reached the EOP step the first time. The unit would jump to the designated step and the program would resume. The "cycles to go" information would now be available for display and computer access.

The loop count functions in the same manner.

This new view screen also displays the Guaranteed Soak values programmed for CH1 & CH2 for the current step. The display will indicate either the numerical value entered for the guaranteed soak in that step or "OFF".

13. CHG_CUR_VAL - (CHANGE CURRENT VALUES)

Item # 2 in the main menu has been changed from "REVIEW PROG" to "CHG_CUR_VAL.

This feature allows you to stop a running program and change the values of the current step for one pass. The original programmed values are restored and used on the next pass.

To change current values proceed as follows:

1. Stop the program by pushing the STOP button

2. Push the PAGE DOWN button to access the Main Menu

3. Push # 2 button (CHG_CUR_VAL)

The first current value screen will appear with the cursor flashing on the Ch 1 setpoint (1_SP).

The current values that can be changed from this screen are:

1 - Cannel 1 Setpoint
2 - Channel 1 Deviation
3 - Channel 2 Setpoint
4 - Channel 2 Deviation
5 - Time remaining in the step
6 - Event status (On/Off)

Use the arrow keys to position the cursor on the item you wish to change.

OR

Push the PAGE DOWN button for the second screen.

The current step values that can be changed are:

1 - Loops remaining (for next loop counter)
2 - Cycles remaining (for entire program)
3 - Next Program and next step number to execute after completion of current step

Make the desired change or changes you wish and push the RUN button.

The unit will resume operation using the new values.

SETPOINTS:

If a setpoint value is changed from the CHG-CUR-VAL screen the Unit will determine if the current step is a Ramp or a Soak.

1) RAMP STEP: The Unit will develop a ramp rate to the new setpoint based on the time remaining in the step.

   The new ramp starts from the last setpoint generated by the 620/600 when it was stopped. The new rate of change is determined by the time remaining in the current step, the last generated setpoint and the new current value setpoint.

2) SOAK STEP: The 620/600 will immediately send the new setpoint to the controller when the RUN button is pushed. The controller will control at this new setpoint for the duration of the step. The next step will be treated as a ramp step to its programmed setpoint.

   CLR Button - Clearing the setpoint will display ---.- in the setpoint display and immediately "kill" the controller outputs for that channel when the cursor is moved.

   The next step will always be a ramp to the next programmed setpoint from the current process value.

DEVIATION ALARMS:

The new deviation alarm value for the selected channel is active as soon as the value is entered and remains active for the duration of the step when the RUN button is pushed.

CLR Button - The displayed DEV_ will be -- and there will be no alarm action for the remainder of the step.

TIME:

The new time entered will be used for the remainder of the current step "ONLY" after the RUN button is pushed.

CLR Button - The displayed time will be 00:00:00 and the
Unit will execute the next sequential program and step number "ONLY" after the RUN Button is pushed.

EVENTS:

The new output states (On/Off) of the selected events will change only after the RUN button is pushed.

The events are divided into two fields, numbered events (1 - 8) and lettered events (A - H). When the cursor is in the number field just push the number button of the event you wish to change.

To access the letter field push the right arrow button and the cursor will go to the letter field. Push the letter button corresponding to the letter event you wish to change.

CLR Button - Do not use the CLR Button in this mode of operation to turn OFF events. Push the number button of the "ON" event(s) to turn it(them) OFF.

SECOND SCREEN

LOOPS:

Only the number of loops remaining for the current nested loop can be changed.

If the loop display shows either ---- or 0, the Unit has not yet reached the loop step for that nested loop and the loop counter has not been updated.

If the ---- or 0 are displayed the number of loops may be changed by entering a new value.

NOTE! DO NOT use the 0 or CLR to change the loops.
Using the 0 or CLR will have no effect.

NOTE! NO CHANGES can be made if the loop counter indicates 1 loop remaining.

The Unit will continue to the next sequential step of the program after the loop step is reached.

CYCLES:

The number of programmed cycles may be changed. The cycles have the same requirements as the loops.

NEXT PGM: & NEXT STEP:

This display shows the next program and step number that
will be executed at the completion of the current step.

Change the NEXT PGM or NEXT STEP to vector the unit to any program or step number you wish the Unit to go to at the completion of the current step.

PROM RELEASE V2.18 FEATURES

JULY 16, 1993

(INCLUDES NEW FEATURES OF V2.17 SHOWN BY " * ")

IEEE488 CAPABILITY OF UTILIZING UPLOAD/DOWNLOAD COMMANDS:

In Prom versions V2.16 and prior the Upload and Download commands could not be used if operating with an IEEE488 interface.

* Ver 2.17 and later (V2.18) now allow the use of the following commands while operating with the IEEE488 Interface:

* ULP n<cr>: Save program "n" from the 600/620 to the Computer
* DLP n<cr>: Down load program "n" from the Computer to the 600/620

* ULD P<cr>: Save the PID parameters from the 600/620 to the Computer
* DLD P<cr>: Down load the PID parameters from Computer to 600/620

* ULD S<cr>: Save all 200 steps from 600/620 to the Computer
* DLD S<cr>: Down load all 200 steps from Computer to 600/620

* LOP<cr>: Read number of loops and "loop to destination"

* GTO<cr>: Read program number and step number for direct jump

* GTI<cr>: Read the program number, step number and what to check to make the jump decision.

---CONFIGURE PROGRAMMER--- ADDITIONAL COMPUTER COMMANDS

CONFIGURE PROGRAMMER:

```
* CRM x<cr>                CRM<cr> reply
  where x = D   for   DUAL
                S   for   SINGLE
                P   for   PASSTHRU
                F   for   FASTRAC
```

CH1\CH2 LIMIT ASSIGNMENTS:

```
L11<cr>  (assign CH1 Limits to CH1 Process)  reply ok<lf>
L12<cr>  (assign CH1 Limits to CH2 Process)  reply ok<lf>
L1S<cr>  (assign CH1 Limits to CH2 Setpoint) reply ok<lf>

L21<cr>  (assign CH2 Limits to CH1 Process)  reply ok<lf>
L22<cr>  (assign CH2 Limits to CH2 Process)  reply ok<lf>
L2S<cr>  (assign CH2 Limits to CH1 Setpoint) reply ok<lf>
```

Query for CH1 & CH2 Limit assignments

```
L1Q<cr>   reply  1<lf>  (CH1 Limits to CH1 Process)
                 2<lf>  (CH1 Limits to CH2 Process)
                 S<lf>  (CH1 Limits to CH2 Setpoint)

L2Q<cr>   reply  1<lf>  (CH2 Limits to CH1 Process)
                 2<lf>  (CH2 Limits to CH2 Process)
                 S<lf>  (CH2 Limits to CH1 Setpoint)
```

*** SYNCHRONIZER MODE: CONFIGURED AND READ BY COMPUTER:**

New command:

```
* SYN 0<cr>    turn SYNC. OFF      reply:  ok
* SYN 1<cr>    turn SYNC. ON       reply:  ok
* SYN<cr>      reply:   0<lf> = Sync OFF,   1<lf> = Sync ON
```

"KILL CONTROL OUTPUTS" AND ZERO INTERGRAL OFFSET FROM INPUT #8

"ON INPUT #8" has added configuration condition:
Disable controller outputs & reset offset registers to zero.

I8A D<cr> reply: ok<lf>
I8A<cr> (query) reply: DISABLE<lf>

This feature operates on an external input signal (GND) on TB6 pin 13 on the A2216 Rear Interconnect PCB. A resistor between 470 and 680 ohms must also be installed between TB6 pins 8 & 9.

Note : I8A N<cr> and I8A R<cr> still works as before.

POWER FAIL ACTION: (If Process(s) is Out of Limits)

* PFA x<cr> (write and read)
where x = N - NORMAL MODE - RECOVER & RESUME
H - HOLD CURRENT VALUES
R - RUN PROG. AT STEP

---CONTROLLER CONFIGURATION--- ADDITIONAL COMPUTER COMMANDS

*** CONFIGURATION AND QUERY OF CONTROLLER INPUT TYPE:**

* IT1 x<cr> for CH1 or * IT2 x<cr> for CH2
where x = T Thermocouple
J "
K "
R "
S "
E "
B "
P for platinum RTD 100 ohm European curve
V for mv
I for current

*** ADDITIONAL UNITS CONFIGURATION AND QUERY:**

ALTITUDE - configuration for the T-Hydronics Model TH-LVA
LIN Table for usable range of 100K FT Altitude
This special LIN table selected as units as **ALTUDE_FT**

* UN1 A<cr> or * UN2 A<cr>, where A is ALTITUDE

HUMIDITY SENSOR - For CH 2 ONLY - USES CH1 TEMPERATURE

* UN2 x<cr>
where x is: x = HV Vaisala HMM30C *
x = HH Hy-Cal IH3602

UN2<cr> reply Humidity-Vaisala or Humidity HY-Cal

* A special function for use with the Vaisala Model HMM30C sensor, compensates for temperature per equation.
In V2.18 the Vaisala operating temperate compensation has been expanded to -40 deg. C to +160 deg. C from +2 deg C to 98 deg. C in Ver 2.17.

NOTE: THE VALUES FOR % RH ARE LIMITED TO 0 % RH - 100 % RH
Any input values representing humidity levels greater than 100 or less than 0 are limited to 100 and 0 respectively.

OUTPUT CURRENT LOOP ASSIGNMENT AND CONFIGURATIONS:

* LA1 x<cr> where x is either 1 (CH1) or 2 (CH2)
* LA2 x<cr> where x is either 1 (CH1) or 2 (CH2)
LA1<cr> reply is CH1 or CH2
LA2<cr> reply is CH1 or CH2

CH1 or CH2OUTPUT CURRENT LOOP VALUES - read & write

* LV1 x<cr> where x is either 0 (0-16MA) or 4 (4-20MA)
* LV2 x<cr> where x is either 0 (0-16MA) or 4 (4-20MA)
LV1<cr> reply is 0-16MA or 4-20MA
LV2<cr> reply is 0-16MA or 4-20MA

OUTPUT CURRENT LOOP TYPE CONFIGURATION - read & write

* LT1 x<cr> (CH1) or * LT2 x<cr> (CH2)

where x is one of following

h	Reverse acting (heat)
c	Direct acting (cool)
d	Dual acting (LOOP 1 ONLY)
n	12 mil Null
s	Setpoint retransmit
p	Process retransmit

MANUAL SETPOINT BUMPLESS SETTINGS:

Manual Mode Setpoints entered either from the Front Panel or Computer now provide direct, smooth output changes from the controllers.

In previous versions, entering a new Manual Setpoint resulted in the controller outputs momentarily turning OFF, then back ON with the new output level.

The new version eliminates the mometary OFF period providing a smooth transition to the new setpoint.

This condition ONLY existed in the Model 620 in the FastTRAC Standard and Passthru modes.

MODEL 620\600 INPUT CALIBRATION FOR TC\TC ON BOTH CHANNELS

EQUIPMENT REQUIRED:
Thermocouple calibration standard (calibrator) such as Wahl Instruments Model C-65 or Biddle Model 720350.
Thermocouple extension wire of the required type.

Both channels use the same Cold Junction. The Cold junction calibration is performed only once at the beginning of the calibration sequence. Prior to calibration it is recommended that the unit be turned on for at least 2 hours to allow the cold junction device to settle in at its ambient operating temperature.

NOTE: The TC input connections on TB1 are as follows:
Pin 1 - NC
2 - CH1 +
3 - CH1 -
4 - CH2 -
5 - CH2 +
6 - NC

Prior to calibration enter the CH1 & CH2 CONTROLLER CONFIGURATION and set the LO_PASS Input filter to "0". After calibration is complete return this setting to it's original value.

DETERMINE THE COLD JUNCTION TEMP.
Note: If the current unit cal. is currently within 3 deg. use procedure A. If it is not within 3 deg. over the temp. range use procedure B.

A. Using a piece of copper wire jumper TB1 pins 2 & 3 (CH1 input).
Read and record the CH1 Process value. This value will be used for the Cold Junction (CJ) and the CH1 & CH2 LO calibrations.

B. Set the calibrator to measure mode. Connect a thermocouple from the calibrator to TB1 pin 3. This TC should be constructed so the TC junction is secured in the TB1 location without any junctions in the free air. This will create a false CJ reading. Read and record the Calibrator measured value. This value will be used for the Cold Junction (CJ) and the CH1 & CH2 LO calibrations.

ACCESS INPUT CALIBRATION:

Push	**<STOP>, <RESET>, <PAGE DOWN>**	(To access Main Menu)
Push	**<4>**	(CONFIG-TUNE-CALIB)
Push	**<3>**	(CALIBRATE INPUTS)
Push	**<PAGE DOWN>**	(COLD JUNCTION cal.)

COLD JUNCTION CALIBRATION:

At the, "**CJ_TEMP.=**", prompt, enter the CJ value previously recorded.
Push **<ENTER>**, Wait 5 to 10 seconds.
Push **<PAGE DOWN>**, The cold junction is now calibrated.

CH1 & CH2 LOW AND HI INPUT CALIBRATION:

Using a short piece of Thermocouple extension wire parallel the CH1 and CH2 inputs on TB1 (pin 2(+) to 5(+) and pin 3(-) to 4(-).

Using a thermocouple extension wire connect the calibrator to TB1 2(+) and 3(-). Both channels are now in parallel with the calibrator and receive the same input.

Set the calibrator to the output mode. Set the calibrator output to the previously recorded Cold Junction value.

The upper right hand display will always indicate the current process value for the selected channel. If the displayed value is not close to the calibrated CJ value, recalibrate the CJ. If it is close continue.

CH1 LO:

At the "**CH1_LO_ACTUAL:**" prompt, enter the calibrator setting via the 620\600 numerical keypad.
Push **<ENTER>**, observe the upper right hand display until it reads the value entered.
Push **<PAGE DOWN>, <PAGE DOWN>, <PAGE DOWN>** (CH2_LO_ACTUAL)

CH2 LO:

At the "**CH2_LO_ACTUAL:**" prompt, enter the calibrator setting via the 620\600 numerical keypad.
Push **<ENTER>**, observe the upper right hand display until it reads the value entered.
Push **<PAGE DOWN>** (CH2_HI_ACTUAL)

CH2 HI:

Set the calibrator output to 200 deg. C.
At the "**CH2_HI_ACTUAL:**" prompt, enter 200 via the 620\600 numerical keypad.
Push **<ENTER>**, observe the upper right hand display until it reads the value entered.
Push **<PAGE UP>, <PAGE UP>, <PAGE UP>** (CH1_HI_ACTUAL)

CH1 HI:

At the "**CH1_HI_ACTUAL:**" prompt, enter 200 via the 620\600 numerical keypad.
Push **<ENTER>**, observe the upper right hand display until it reads the value entered.
Push **<RESET>**

Verify calibration by running the calibrator up and down the scale and observe the CH1 and CH2 process displays for accurate tracking.

If both channels track OK.

Calibration is complete.

If both channels do not track properly:

Push **<PAGE DOWN>, <4>, <3>, <PAGE DOWN>, <PAGE DOWN>** (CH1 LO_ACTUAL)
Recalibrate CH1 & CH2 LO and HI Input calibration.

Don't forget to set the LO_PASS Input Filter to it's original value.

MODEL 620\600 INPUT CALIBRATION FOR RTD (100 ohm)

***EQUIPMENT REQUIRED*:** Precision Decade resistance box.

There is no Cold Junction calibration performed for RTD units.
Prior to calibration it is recommended that the unit be turned on for at least 2 hours to allow it to stabilize to ambient operating temperature.

NOTE: RTD input connections on TB1: Pin 1 - Shield
2 - CH1 +
3 - CH1 -
4 - CH2 -
5 - CH2 +
6 - Shield

Prior to calibration, from the CH1 & CH2 CONTROLLER CONFIGURATION set the LO_PASS Input filter to "0". After calibration return setting to it's original value.
The upper right hand display will always indicate the current process value for the selected channel.
After pushing the *<ENTER>* button for each input calibration (Wait) and observe the upper right hand display until it is stable and reads the value entered.

ACCESS INPUT CALIBRATION:

Push	**<STOP>, <RESET>, <PAGE DOWN>**	(To access Main Menu)
Push	**<4>**	(CONFIG-TUNE-CALIB)
Push	**<3>**	(CALIBRATE INPUTS)
Push	**<PAGE DOWN>**	(COLD JUNCTION cal.)
Push	**<PAGE DOWN>**	(CH1_LO ACTUAL)

CH1 LOW AND HI INPUT CALIBRATION:
Connect the decade box to the CH1 inputs, TB1 pin 2(+) & 3(-) and jumper 1 to 3.
Set the decade box output to 100.00 ohms (0.0 deg. C).

At the "**CH1_LO_ACTUAL:**" prompt, enter 0.0 via the 620\600 numerical keypad.
Push **<ENTER>**, (Wait) then
Push **<PAGE DOWN>**, (CH1_HI_ACTUAL)

Set the decade box output to 212.01 ohms (300.0 deg. C).

At the "**CH1_HI_ACTUAL:**" prompt, enter 300.0 via the 620\600 numerical keypad.
Push **<ENTER>**, (Wait) then
Push **<PAGE DOWN>**, (CH2_LO_ACTUAL)

CH2 LOW AND HI INPUT CALIBRATION:
Connect the decade box to CH2 inputs, TB1 pin 4(+) & 5(-) and jumper 4 to 6.
Set the decade box output to 100.00 ohms (0.0 deg. C).

At the "**CH2_LO_ACTUAL:**" prompt, enter 0.0 via the 620\600 numerical keypad.

Push **<ENTER>**, (Wait) then
Push **<PAGE DOWN>**, (CH2_HI_ACTUAL)

Set the decade box output to 212.02 ohms (300.0 deg. C).

At the "**CH2_HI_ACTUAL:**" prompt, enter 267 via the 620\600 numerical keypad.
Push **<ENTER>**, (Wait) then
Push **<RESET>** Return to Home **(STOP)** screen

Verify calibration by running the decade box up and down the scale and observe the CH1 and CH2 process displays for accurate tracking.
If both channels track OK. Calibration is complete.
Don't forget to set the LO_PASS Input Filter to it's original value.

MODEL 620\600 INPUT CALIBRATION FOR CHANNEL 2 ONLY FOR LINEAR INPUT OF 4-20MA FOR 0 - 100% RH

EQUIPMENT REQUIRED: 4-20MA CURRENT SOURCE TO PROVIDE INPUT TO CH2.

NOTE: The CH2 input connections on TB1 are as follows: (pin 4 "-", pin 5 "+")

Pin 1 - NC
2 - + CH1
3 - - CH1
4 - - CH2
5 - + CH2
6 - NC

ACCESS INPUT CALIBRATION: **NOTE: ONLY PUSH <ENTER> WHEN INSTRUCTED.**

Push <STOP>, <RESET>, <PAGE DOWN> (To access Main Menu)
<4> (CONFIG-TUNE-CALIB)
<3> (CALIBRATE INPUTS)
<PAGE DOWN> 5 times to CH2 LO_ACTUAL SCREEN

Connect the current source output to TB1 pin 4 (-), and pin 5 (+).
Set the output of the source to 4.0MA.

At the CH2 LO_ACTUAL: CALIBRATOR SETTING. prompt, push 0 on the keypad.
Push <ENTER>
Wait app. 10 seconds.

Push <PAGE DOWN>

Set the current source output to 20.0MA.
At the CH2 HI_ACTUAL: CALIBRATOR SETTING. prompt, push 100 on the keypad.

Push <ENTER>
Wait app. 10 seconds.

Run the calibrator up and down to produce an output between 4 & 20 MA.
The following correlation should occur:

MA input to CH2	Actual reading on CH2
4.0	0.0
8.0	25.0
12.0	50.0
16.0	75.0
20.0	100.0

Push <RESET>, this will return you to the STOP Screen.

MODEL 620\600 CHANNEL 2 INPUT CALIBRATION FOR VAISALA MODEL HMM30C RH SENSOR 0.0 TO 5.0 VDC INPUT

EQUIPMENT REQUIRED: 0.0 - 5VDC VOLTAGE SOURCE TO PROVIDE INPUT TO CH2.
Thermocouple extension wire or jumper for CH1 input.

NOTE: The TB1 input connections are CH1 (2 "+", 3 "-") and CH2 (4 "-", 5 "+").
There may be an external M355 input board located on the back of the unit connected to TB1 pins 4 & 5, CH2 input. If so, the voltage input is connected to the M355 board. The TC extension wire or jumper must be connected across TB1 2 & 3 for the channel 2 process variable to read correctly when the controller is out of the calibration mode.

NOTE: If the channel 1 process is not reading between **-40 to +160 deg. C** (operating range of the Vaisala sensor), the CH2 process will display **ErrRH** and shut the controller down.

TB1 Pin **2 - + CH1**
3 - - CH1
4 - - CH2
5 - + CH2

Connect the TC extension wire or jumper to TB1 pin 2 (+) and pin 3 (-).
Connect the voltage source output to TB1 pin 4 (-), and pin 5 (+) or the M355 board.

CONFIGURE UNIT FOR CALIBRATION:

From the ***MAIN MENU***
Push **<4>** (Config.Tune\Calib)
Push **<2>** (Config Contrls\ tune)
Push **<2>** (Config CH2)

If the **CH2 UNITS** are not set for **LINEAR** -
Push **<SEL>** for **LINEAR** (Else)
Push **<DOWN ARROW>**

If **INPUT** is not set for **LINEAR MV** -
Push **<SEL>** for **LINEAR MV** (Else)
Push **<DOWN ARROW>**

If **SPAN - SETPOINT** is not set for Max **105**, Min **-5**
Input 105 for Max value from keypad (then)
Push **<RIGHT ARROW>**
Input -5 for Min value from keypad

ENTER CHANNEL 2 CALIBRATION:

NOTE: ONLY PUSH <ENTER> WHEN INSTRUCTED.

Push **<PAGE UP>**
Push **<PAGE UP>**
Push **<3>** (Calibrate Inputs)
Push **<PAGE DOWN>** (Cold Junction)
Push **<PAGE DOWN>** (CH1_LO ACTUAL)
Push **<PAGE DOWN>** (CH1_HI ACTUAL)
Push **<PAGE DOWN>** (CH2 Status Screen)
Push **<PAGE DOWN>** (CH2_LO ACTUAL)

Set the output of the voltage source to **0.0 VDC**.

At the **CH2 LO_ACTUAL: CALIBRATOR SETTING**. prompt,
Push" **0.0**" on the keypad.
Push **<ENTER>**
Wait app. 10 seconds.
Push **<PAGE DOWN>**

Set the voltage source output to **5.0 VDC**.

At the **CH2 HI_ACTUAL: CALIBRATOR SETTING**. prompt,
Push **100.0** on the keypad.
Push **<ENTER>**
Wait app. 10 seconds.

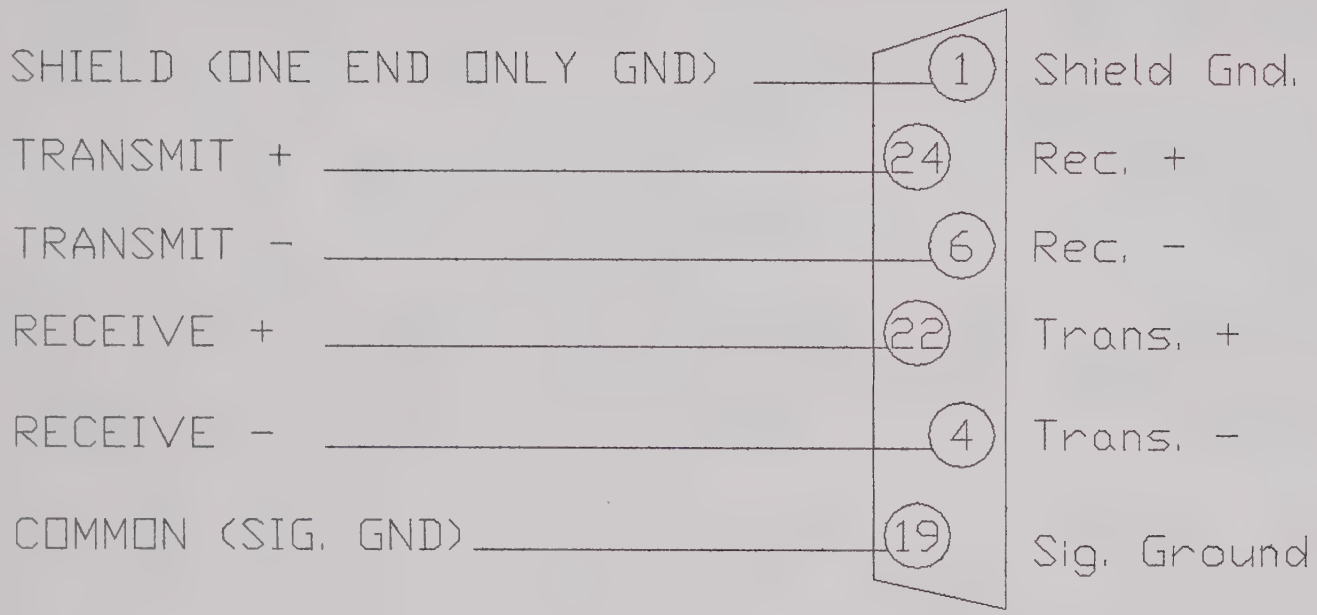
Push **<PAGE DOWN>**
Push **<2>** (Config Contrls\Tune)
Push **<2>** (Config CH2)
Push **<SEL>** (For RH_VAISALA)
Push **<RESET>** (To HOME -STOP Screen)

Calibration is complete

Changing the channel 2 input value from 0 to 5vdc vary the process reading between 0 to 100 %.
This is NOT a linear relationship. ie. 2.5 vdc is not equal to 50. With the temperature compensation built into the unit there will be a minor non-linear relationship between the voltage input and the process display. This is correct.

NOTE: Whenever a new *Input Type* is selected from the *Controller Configuration*, the controller outputs will be disabled.
If the *Current Loop* outputs are selected for *Setpoint or Process Retransmit* they will latch on the last output value they were at when the new Input Type was selected.
To reactivate the outputs, it is necessary for the controller to receive a new setpoint either from the Manual Mode or by running a program.

620/600
422 Connections



422CONN
1/18/95

JC SYSTEMS, INC.
SAN DIEGO, CA.

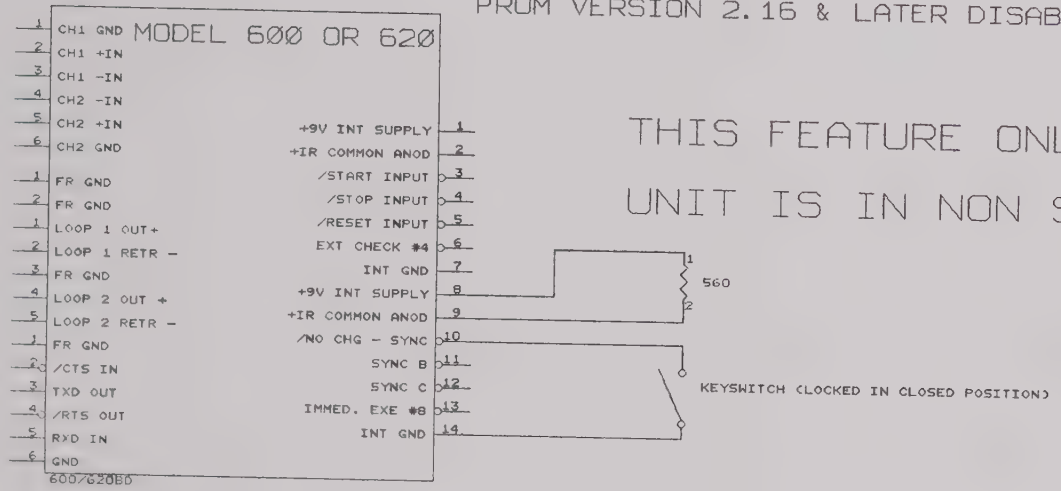
KEYSWITCH LOCKOUT WIRING FOR 620/600 UNITS

NOTE: A CLOSED KEYSWITCH PROHIBITS ACCESS TO SELECTIONS (2) CHANGE_CURRENT_VALUE, (3) EDIT Program, AND (4) CONFIG_TUNE_CALIBRATE .

PROM VERSION 2.14 - 2.15 DISABLES SELECTION 2 & 3.

PROM VERSION 2.16 & LATER DISABLES SELECTION 4 ALSO.

THIS FEATURE ONLY WORKS IF THE UNIT IS IN NON SYNCHRONIZED MODE.



JC SYSTEMS INC. 11535 SORRENTO VALLEY RD. SAN DIEGO, CA. 92121 619 793-7119	
Title	KEY SWITCH WIRING TO 600 OR 620
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User's Instructions for the FastTrac™ 620 Programmer/Controller

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YOUR FEEDBACK WELCOME:

We welcome your comments and suggestions regarding this technical manual and the equipment it describes. Please contact:

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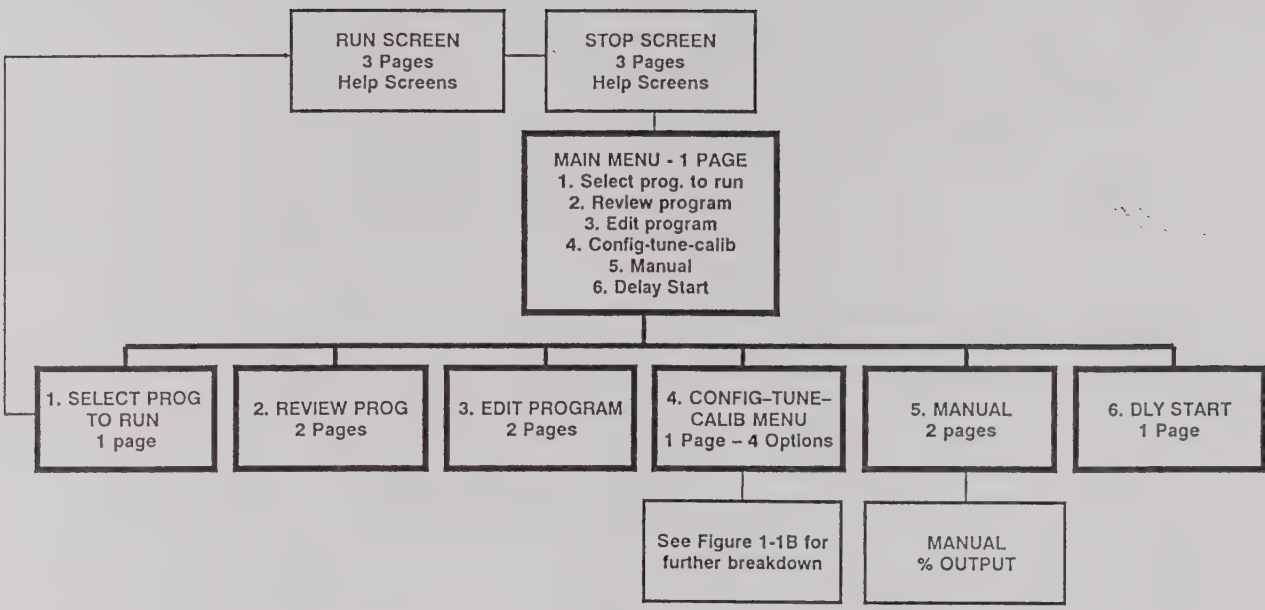


Figure 1-1A. Model 620 Menu Structure.

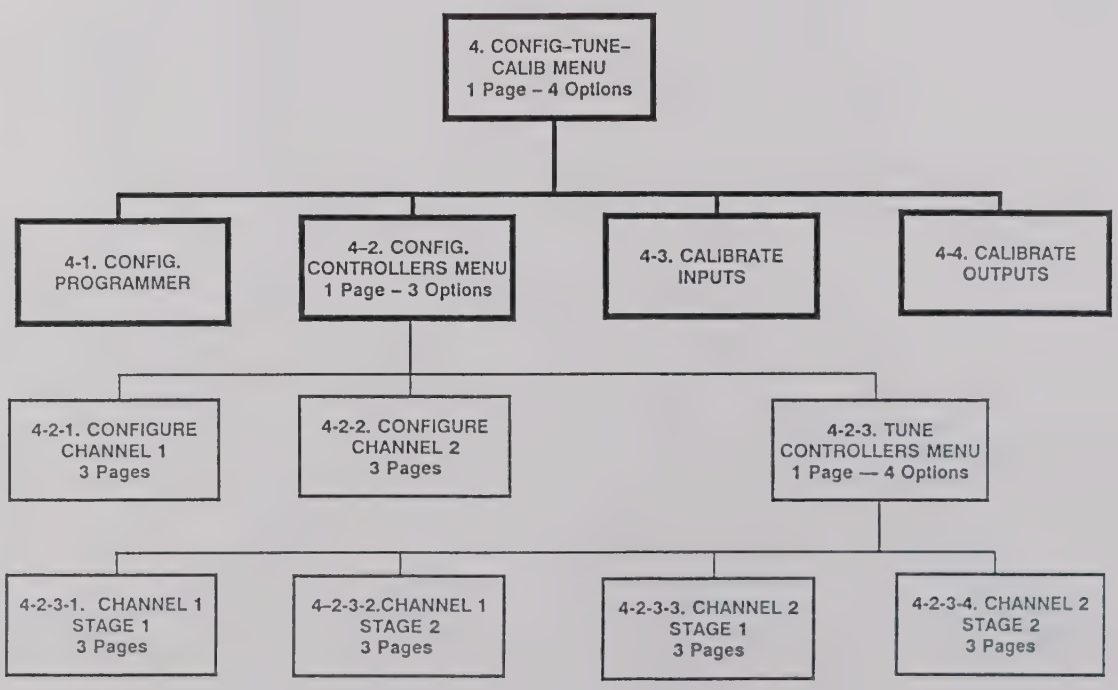


Figure 1-1B. Config-Tune-Calib Menu Hierarchy.

1. INTRODUCTION

1.1 Fast Start for FastTRAC™ 620

This Fast Start summary provides a quick overview of FastTRAC™ 620 controls and operation. If you're familiar with process temperature control, you can probably start using your FastTRAC™ 620 right after you review this section. To get the most out of your Model 620, you should review the rest of manual as well. It contains specific details and step-by-step procedures that couldn't be covered in this brief overview.

1.1.1 How the Displays Are Organized

The FastTRAC™620 displays information on two 2-line, 20-character liquid crystal displays (LCD). Each information display is called a *page*. Each major FastTRAC™ function has one or more pages.

When you first turn on the FastTRAC™ 620, it comes up in the Stop mode. Press PAGE DOWN to display the Main Menu. From there, you can access any other function by pressing its menu number on the keypad.

Figure 1-1 shows how the FastTRAC™ displays relate to one another. The system is designed to let you proceed logically through each step of configuring the Model 620 and programming your profile. Respond to the prompts on each page, then press PAGE DOWN to move to the next one.

In Edit or Review mode, each step of a program has two pages. In these modes, you are returned to the first step of the program when you review or enter an end-of-program step.

For all other functions, the number of pages varies (see Figure 1-1). When you reach the end of a function, you usually will be returned to the menu where you selected the function.

1.1.2 Using the Control Panel

Figure 1-2 shows the FastTRAC™ 620 control panel. Its keys and indicators are explained below. Keys are grouped according to their color coding. Item numbers refer to the callout numbers in Figure 1-2.

1.1.2.1 Operating Keys (Gray on Left, Item 1)

These keys control FastTRAC™ 620 operation.

Pressing **RUN** starts FastTRAC™ 620 operation from either the Stop Mode or Main Menu option 1 ("SEL PROG TO RUN"). Line 4 of the display shows "RUN" in the status (second) field. While in Run mode, press PAGE DOWN to review the parameters for the current step. Press HELP (the black key, Item 2) to see an explanation of the information on each page.

Pressing **STOP** while in Run mode interrupts system operation. The clock stops and the program freezes at present conditions and holds there until the RUN key is pressed to resume operation. Line 4 of the display shows "STP" in the status (second) field. Press HELP (the black key, Item 2) to see an explanation of the information displayed.

Pressing **RESET** from stop mode resets to the beginning of step 1 in the current program. From any other mode, pressing RESET places you in Stop mode at the last recorded program position.

1.1.2.2 Help Key (Black, Item 2)

Pressing the **HELP** key displays information that explains the contents of the Stop and Run mode screens.

1.1.2.3 Move Keys (White with Blue Border and Black Letters, Item 3)

PAGE UP moves the display to the preceding page.

PAGE DOWN moves the display to the next page.

- In Stop mode, PAGE DOWN displays the Main Menu.
- In Run mode, PAGE DOWN displays two additional pages of real-time information about the program that is running. These pages time out in about 10 seconds.
- In Edit mode, if the selected program is empty, pressing PAGE DOWN inserts a Standard step without program parameters as step 1 of the selected program number.
- In Review Prog(ram) or Edit modes within a current program, PAGE DOWN moves to the second page for the step, or if on the second page, to the first page of the next step. On an EOP step, PAGE DOWN returns to the first step of the program.
- From the last page of Main Menu Option 4 functions, PAGE DOWN returns to the menu from which the function was selected.
- PAGE DOWN is inactive on the last pages of Main Menu Options 5 and 6.

NOTE

In Edit mode, pressing either of the PAGE keys stores the current value in the active field before the move takes place.

SEL toggles or scrolls between two or more choices in one field, such as YES/NO or ON/OFF.

1.1.2.4 Data Keys (Solid Blue, Item 4)

Use the **numerical keypad** to choose a menu option, enter numerical program parameters, or change the status of events. The cursor position tells the FastTRAC™ 620 when to use letters, which are active only for the last eight events (A-H). Pressing the ./: key moves the cursor into the decimal or time position. The – (minus) key toggles between negative (–) and positive values.

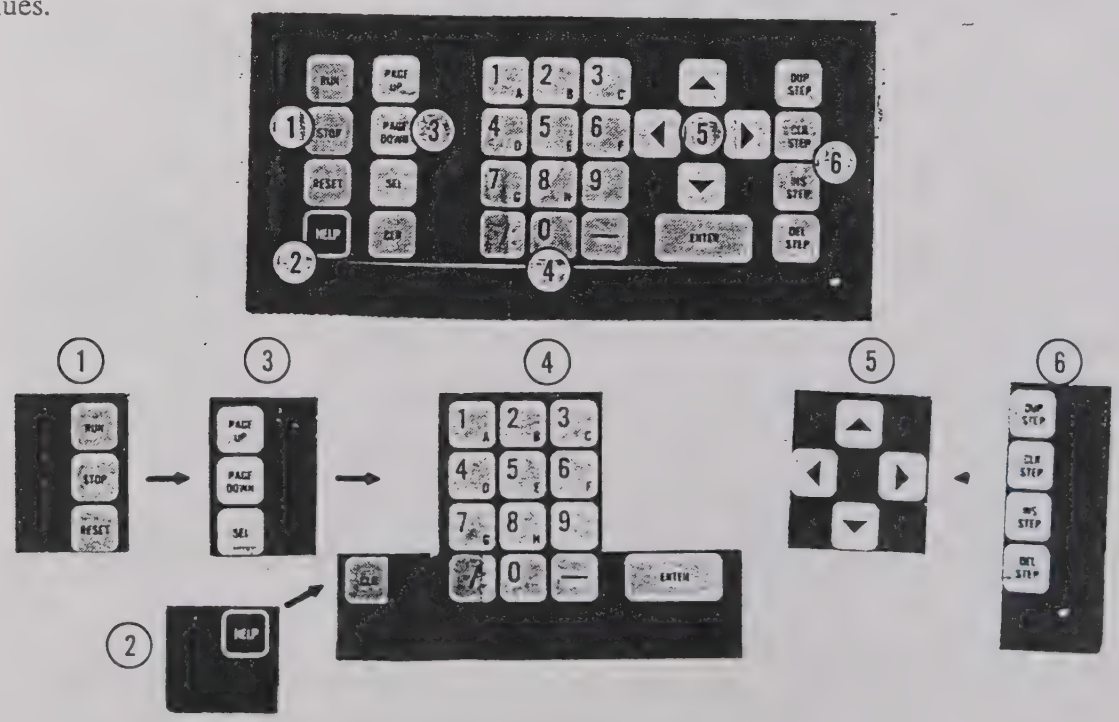


Figure 1-2. Model 620 Control Panel.

The **CLEAR** key removes numerical data from the current field (current cursor position).

The **ENTER** key can be used to record a value inputted via the keypad and then move to the next active field. However, pressing any of the move keys (PAGE UP, PAGE DOWN, or arrow keys) will automatically record the current value.

1.1.2.5 Cursor Arrow Keys (Black Arrows on White Ground, Item 5).

The left ← and right → arrows either move the cursor between spaces in a field or to other active fields. The up ↑ and down ↓ arrows move the cursor to other lines of the display within active fields.

NOTE

In Edit mode, pressing any of the arrow keys stores the current value in the active field before the move takes place.

1.1.2.6 Edit Keys (Gray Keys on Right, Item 6)

These keys, active only when editing a program, perform operations on an entire step rather than individual parameters.

DUP STEP duplicates the current step as the next step in the sequence and advances the step number by one. The display remains on the same page it was on for the duplicated step. In other words, if you press DUP STEP while on the second page of Step 3, the display changes to the second page of Step 4. All later steps increase by one.

If you press the DUP STEP key more than once, you move to the same page of the last duplication.

CLR STEP removes all programmed information for the step being edited and sets the step type to Standard.

INS STEP inserts a Standard step without program parameters immediately following the currently displayed step. If the program is empty, the step is inserted as step 1 of the selected program number.

In either case, the display changes to the same page of the new step, and any later steps in the program are renumbered (remaining step numbers increased by one).

DEL STEP deletes the currently displayed step and renumbers all later steps in the program (decreases remaining step numbers by one). The step number displayed remains the same, but the settings are those of the next step in the original program. For example, if you delete Step 4, the new Step 4 will be displayed with the original settings for Step 5.

1.1.2.7 Indicators (Not Shown)

CH1 & CH2 INC — Red LEDs light above the channel identification whenever the process value for the indicated channel is increasing.

CH1 & CH2 DEC — Red LEDs light below the channel identification whenever the process value for the indicated channel is decreasing.

1.1.3 Programming and Operating Basics

1.1.3.1 Programming

NOTE

This procedure assumes no program is present.

1. From the Stop screen, press PAGE DOWN to access the Main Menu, then press 3 to select EDIT.

2. Press PAGE DOWN to insert a standard (ramp/soak) step as Step 1. Use the arrow keys to move the cursor to the Step Type field and press SEL to change the type.
3. If guaranteed soak is desired, use the arrow keys to move the cursor to the applicable field and enter the soak time using the numeric keypad. (With guaranteed soak enabled, the clock for that step will not start until specified parameters exist.)
4. Press PAGE DOWN to move to the next page and enter remaining parameters for Step 1 using the numeric keypad. The numeric keypad also toggles events between off (•) on (number or letter displayed), or doesn't matter (x).
5. Press DUP STEP to create a Step 2 same as Step 1 (which can then be revised), or press PAGE DOWN to create a standard Step 2 without parameters. Enter or revise parameters as desired.
6. Repeat Step 5 until all steps except the end-of-program (EOP) step have been entered. Then create the EOP step as follows:
   a. Press PAGE DOWN and change the step type from STANDARD to EOP.
   b. If you want all or part of the program to cycle, enter the beginning step number for the cycle and the number of cycles desired.
   c. Press PAGE DOWN to return to the first step of the program.

1.1.3.2 Operating

1. If you are continuing from Step 6.c above, press PAGE UP to return to the Main Menu.
2. If you are starting from power- up (Stop screen displayed) and the display shows the program and step you want to run, press RUN to start. If you need to change the program or step number, press PAGE DOWN to access the Main Menu and proceed with Step 3.
3. From the Main Menu, press 1. Select the desired program and step number (if different from those shown) using the numeric keypad, then press RUN.

   While the programming is running, the FastTRAC™ 620 continuously displays the real-time setpoints, process variables, and status of events on the first two lines. The second two lines display the current program and step number, time remaining on the current step, Operate Mode — LCL (front panel) or RMT (external computer); Run status [RUN or PAU(se)]; and alarm status (flashing if present).

   Press PAGE DOWN to display additional information. Pressing PAGE DOWN once displays the deviation alarm limits, selected units (C, F, L(inear), RH/WB), and programmed setpoints for Channels 1 and 2, as well as the next step for the profile.

   Pressing PAGE DOWN twice displays the high and low process limits, the real-time percent output, and the PID stage (1 or 2) in use for both channels. It also displays the current programmer configuration — 2-channel or FastTRAC™ (standard or passthru). Press and hold down the HELP key from any page to see an explanation of the information shown.

NOTE

The two additional information screens time out in about 10 seconds. The profile continues to run while these screens are displayed.

4. If a flashing S1 or S2 code appears in the ALM field, press STOP to halt the program and correct the problem. (See Chapter 4 for an explanation of alarm codes.)
5. At any time, you can press STOP to halt programmer operation, which stops the clock and latches the current setpoint.

6. Once you halt the program, you have three restart options.
   a. To restart the program at the point of interruption, press RUN.
   b. To restart the program at Step 1, press RESET, then press RUN.
   c. To restart on a different step, access option 1 on the Main Menu, move the cursor to the step number field and change the number using the numeric keypad or up/down arrow keys, then press RUN.

1.2 MORE ABOUT THE FastTRAC™ 620

The JC Systems Model 620 FastTRAC™ (**T**hermal **R**esponse **A**ccelerating **C**ontrol) system is a dual-channel setpoint programmer/controller that's menu-driven for ease of use.

This JCS product includes many features that result in easier use and more effective applications. These include random access to any program or step within the programmer's memory; internal nested looping capability in addition to repeating the complete program, soft start selectable for each step to prevent thermal stress to devices under test; selectable deviation limits; a split-range current loop for reverse/direct, setpoint, and process retransmit output; long- life battery backup for program memory, and many other features. (See the product data sheet provided at the beginning of this manual for more information on features.)

The FastTRAC™ 620 is designed to program and perform direct digital control of temperature and related process values, such as pressure or humidity. It comes equipped with RS-232C and RS-422A/485 interfaces. The IEEE-488 communication interface is available as an option.

The Model 620 has three operating modes: as a conventional single- or dual-channel programmer/controller; as a FastTRAC™ 620, and as a FastTRAC™ 620 in pass-through mode.

1.2.1 FastTRAC™ Operating Modes

1.2.1.1 FastTRAC™ Standard Mode

The FastTRAC™ operating mode uses cascade-control strategy and proprietary JCS firmware to maximize the performance of any environmental chamber test program.

It can decrease by 50% or more the thermal response time of a device under test (DUT), completely eliminating the need for complicated, time-consuming thermal response characterizations. With FastTRAC™, the focal point for chamber temperature control can either be the actual temperature of the DUT itself, or the temperature of the air envelope surrounding the DUT (meeting MIL-STD-810D requirements).

FastTRAC™ includes a thermal boost capability that permits precisely controlling the maximum and minimum temperatures within user-defined limits. Since heating and cooling are based on real-time measurements of the DUT's actual temperature, ramp or step temperature changes are achieved with almost no temperature overshoot.

1.2.1.2 FastTRAC™ Pass-thru Mode

In Pass-thru mode, the primary loop controller setpoint is not modified by firmware and is passed directly to the secondary loop. In this case, the unit functions as a single-channel, standard air temperature control system. ThermoBoost™ and temperature limit features of FastTRAC™ are disabled in Pass-thru mode.

1.2.2 Temperature Control

FastTRAC™ uses two channels to control chamber operation. The primary loop, Channel 1, is a modified PID direct digital controller that controls part temperature. It reads the actual part temperature directly from an attached thermocouple or resistance temperature detector (RTD), compares this input with the desired setpoint, and generates a desired chamber air temperature for the second loop, Channel 2, through the programmer.

A selectable ***ThermoBoost***™ value for the primary controller specifies the maximum allowable difference between the part temperature setpoint and the air temperature setpoint called for by primary controller output. This feature makes it possible to further accelerate DUT temperature changes while insuring that the device is not damaged by extreme temperatures.

The secondary loop, Channel 2, is a PID direct digital controller which uses the air temperature setpoint generated by Channel 1 to control chamber air heating and cooling. This is accomplished via the Channel 1 outputs on the Output Interface Board.

NOTE

Always connect chamber air temperature controller outputs to Channel 1. In FastTRAC™ operating modes, Channel 2 outputs are automatically switched internally to drive the Channel 1 output lines on the Output Interface Board. No signal reaches Channel 2 outputs in FastTRAC™ mode.

1.2.3 Principal Components

Principal components of the system, shown in Figure 1-3, are its front panel, which contains all operating controls; the rear interconnect and output interface printed circuit boards (PCB), where electrical connections are made; the PCBs within the case, and the case itself. All operational settings are front-panel or software-selectable; there are no switches to set. Procedures for making electrical connections to the unit are given in Chapter 2.

1.2.4 How to Use This Manual

1.2.4.1 How to Find Information

Table of Contents — This reference aid lists major topics in the order they appear. It's an outline of the manual that also shows the page on which the discussion of each topic starts. All the figures and tables are listed separately at the end of the table of contents.

Index — The index is on the very last pages of the manual. It indexes each paragraph and subparagraph of the manual in alphabetical order.

Reference Drawings — Reference drawings are available on request from JC Systems. To obtain drawings, complete the release form at the end of the manual and return the form to JC Systems.

1.2.4.2 How the Manual Is Organized.

Chapter 1 provided a brief overview of FastTRAC™ 620 operation. It includes an explanation of the control panel keys.

Chapter 2 summarizes the applications, components and features of the Model 620 FastTRAC™ system.

Chapter 3 describes how to install the unit and connect it to your system.

Chapter 4 provides two programming tutorials in the form of step-by-step examples. These show you how to program two typical temperature profiles that incorporate the Model 620's commonly used capabilities.

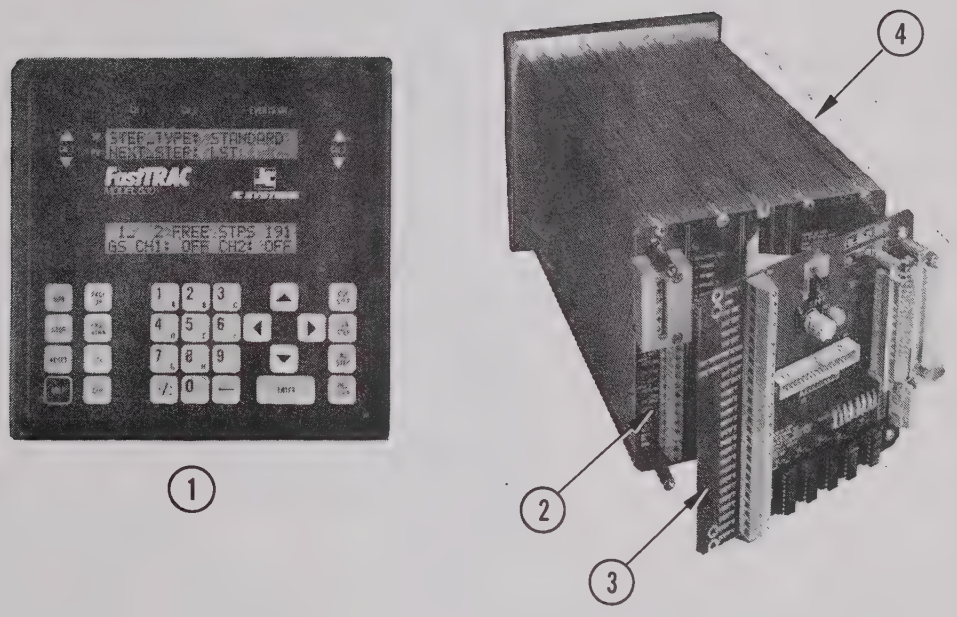


Figure 1-3. Model 620 Principal Components.

Chapter 5 gives detailed instructions about running the system. It describes standard 2-channel, FastTRAC™, FastTRAC™ pass- thru, and manual mode operation.

Chapter 6 describes remote computer operation, including interface connection instructions.

Chapter 7 explains how to set or change the configuration of the programmers and controllers.

Chapter 8 lists maintenance and calibration procedures.

Appendix A provides detailed instructions for fine-tuning PID parameters. Appendix B contains a sample program worksheet. You can make as many copies of this as you need for your own use.

1.3.3 Conventions Used in This Manual

1. Names of pushbutton switches and displays are shown in ALL CAPITAL LETTERS. If the name appears on the equipment, spelling is exactly as shown there.

   Example: DUP STEP

2. If an item is shown on a figure, the figure callout (item number) appears in parentheses after the item name is mentioned for the first time in each paragraph or step.

   Example: TB2-1 (Figure 2-5, Item 3).

NOTE

The text does not normally include references to figures showing the front panel keys, which are shown in Figure 1-2.

If the figure number does not appear with the item number, the item is on the last figure number referenced.

Example: Refer to Figure 2-5 and proceed as follows.

1. Connect thermocouple leads to TB2-1 (Item 1) as shown.

3. Standard abbreviations are not defined. However, the first time a non-standard abbreviation or acronym is used, its meaning is spelled out in parentheses.

Example: PCB (printed circuit board).

2. Installation

2.1 INFORMATION PROVIDED

This chapter describes unpacking and mounting the FastTRAC™ 620 and making power and interface connections for local operation. Additional connections required for remote computer operation are described in Chapter 5.

2.2 UNPACKING

Remove all protective packing and tiedowns from the Model 620 and remove the programmer/controller from its shipping container.

2.3 MOUNTING

2.3.1 Rack Mounting

The Model 620 is approximately 11 in. long overall and mounts in a standard 1/2-DIN (5-3/8 in. or 137 mm sq.) cutout. Optional mounting plates for a standard 19-in. electronic rack are available in one- or two-cutout configurations.

To install the Model 620 in a cutout, proceed as follows.

1. Remove the two screws securing the pushrods and pushblocks at the top and bottom of the Model 620. Remove the rods and blocks.

2. Slide the Model 620 case into position from the front side of the cutout.

3. Slide the top pushblock into the top center groove on the rear of the case. Push the block forward until it contacts the mount ing panel.

4. Insert the top pushrod into the same groove as the pushblock and slide it forward until it contacts the pushblock.

5. Install and tighten the screw that secures the pushrod.

6. Repeat Steps 3-5 for the bottom pushblock and pushrod.

2.3.2 Bench Mounting

For bench use, be sure to install rubber feet (available at no charge from JC Systems) on the bottom of the Model 620 to prevent damage to the benchtop.

2.4 CONNECT ELECTRICAL POWER

Connect 115V, 50/60 Hz AC power at TB5 of Rear Interconnect Board (Figure 2-1, Item 1).

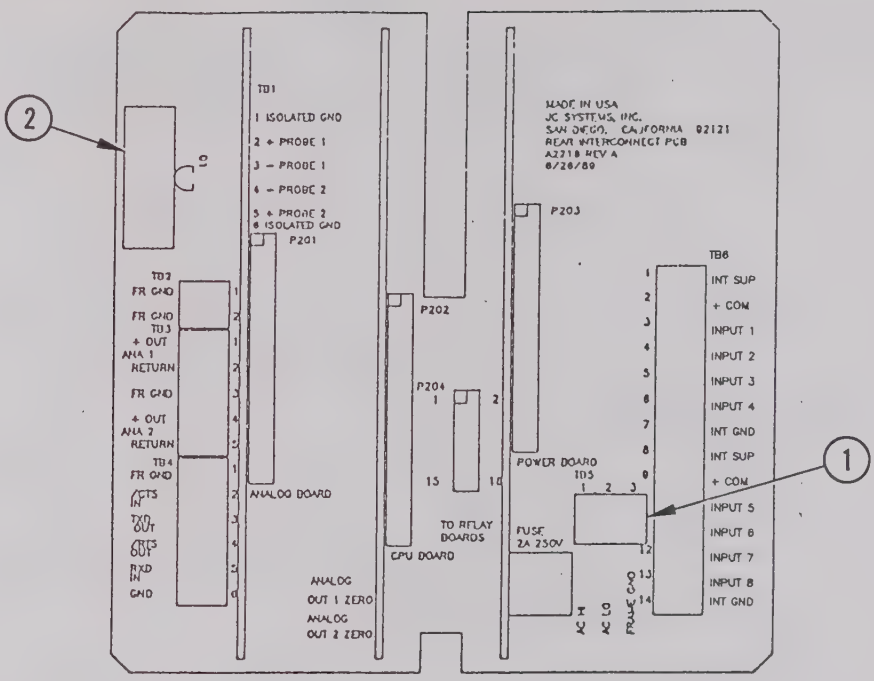


Figure 2-1. Rear Interconnect Board.

2.5 CONNECT TEMPERATURE/LINEAR INPUTS

Gain access to the Rear Interconnect Board (Figure 2-1) by swinging out the hinged Output Interface Board. Connect sensor (thermocouple or RTD) or linear (voltage or current) inputs at temperature input terminal board TB1 (Item 2) on the Rear Interconnect Board.

NOTE

Use only the inputs your unit has been configured to accept. The model number for your unit, shown on the identification plate on its side, specifies the configuration of your unit as shipped.

2.5.1 Thermocouples

Use terminals 2 and 3 for Channel 1 of the Model 620, and terminals 4 and 5 for Channel 2.

2.5.2 RTD Sensors

An RTD input board must be installed on the Model 620's Analog Input Board before RTD inputs will function.

Use the same terminals as described for thermocouples. When using two-wire RTD sensors, connect one sensor wire each to the second and third terminals (TB1-2 and -3 for Channel 1). Then connect the first and third terminals (1 and 3 in our example) with a short jumper wire.

When using three-wire RTD sensors, connect the two same-colored wires to the first and third terminals. Connect the remaining wire to the second terminal; if a shield is present, connect that to one of the frame grounds provided on TB2.

2.5.3 Linear Voltage or Current

The appropriate resistor network must be installed on the thermocouple or RTD board located on the Model 620's Analog Input Board before linear inputs will funciton.

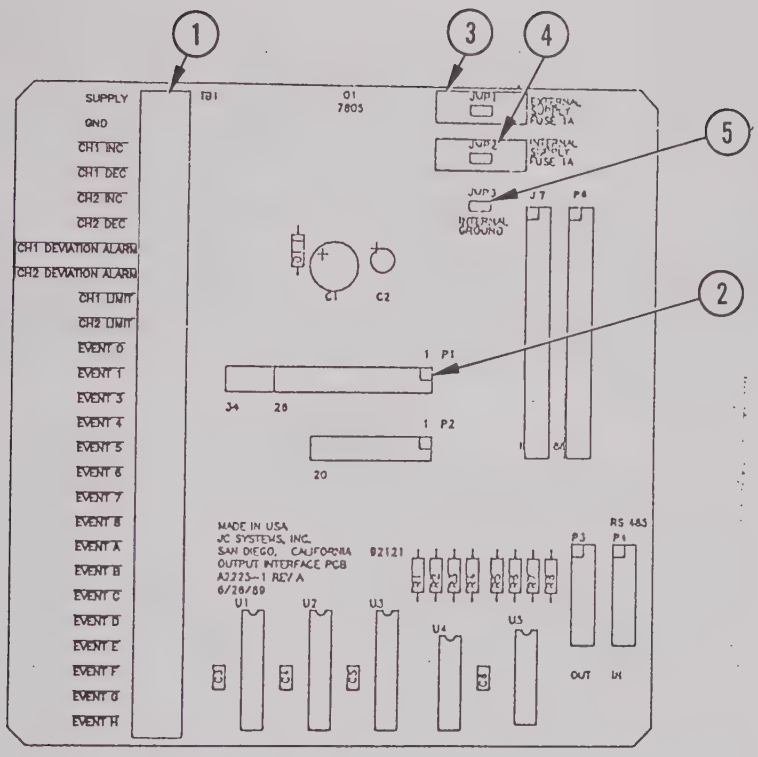


Figure 2-2. Output Interface Board.

2.6 CONNECT OUTPUTS

2.6.1 Connect Time-proportioning Outputs

Connect controller channel time-proportioning outputs (located on TB1 of the Output Interface Board) to the heat and cool SSR (solid-state relays) at the appropriate terminals [TB1-3 (Heat) and -4 (Cool) for Channel 1, or -5 (Heat) and -6 (Cool) for Channel 2.] TB1-1 is the +9V supply. Figure 2-2 shows connections for typical applications.

2.6.2 Connect Power Proportioning (Current Loop) Output

NOTE

You must configure the appropriate controller channel for desired current loop operation when you use this setup. See Chapter 6.

Connect the 4-20 mA proportional current loop output from TB3 on the Rear Interconnect Board (Figure 2-1). Use TB3-1 (+) and -2 (-) for Channel 1, or -4 (+) and -5 (-) for Channel 2.

2.6.3 Connect Outputs to Photo-isolated SSR

Connect ALARM, EVENT, and LIMIT outputs to appropriate terminals of TB1 on the Output Interface Board (Figure 2-2, Item 1). If you are using the Model 620 Event Relay Board, you can connect the cable supplied with that accessory directly to P1 (2); the connector pin assignments correspond with the terminals on TB1.

All outputs are open collector logic type limited to 50 mA and 50 Vdc maximum. The Model 620 as shipped is configured to supply the Output Interface Board from the internal +9V source. To take advantage of this board's complete photo-isolation capability when using an external supply voltage, install jumpers JMP1 (3) and JMP3 (5) and remove jumper JMP2 (4). Connect external +9V power supply and external ground to TB1-1 (+) and -2 (-), respectively.

2.7 CONNECT SYNCHRONIZED PROGRAMMERS

The Model 620 can be synchronized with up to 10 similarly configured daisy-chained units so that all units stop and start together. If any one synchronized unit stops for any reason, all units will stop and wait until all units are ready to run again. All units must be on, in the RUN state, and have the synchronizer capability enabled (see Programmer Configuration in Chapter 6) before any/all will run.

NOTE

If the Model 620 does not have the synchronizer option installed, the synchronizer *must be disabled* for the programmer to run.

A Model 620 with the synchronizer option installed has a modified Output Interface Board that provides for pin-to-pin connections between synchronized units on TB1 pins 2 thru 5 as shown in Figure 2-3. The Output Interface Board TB1 pins are factory wired directly to pins 10, 11, 12 and 14 of TB6 on the Rear Interconnect Board.

If no cable is connected between the TB1 terminals, or if the programmer is not configured for synchronization, the programmer functions as a normal standalone type.

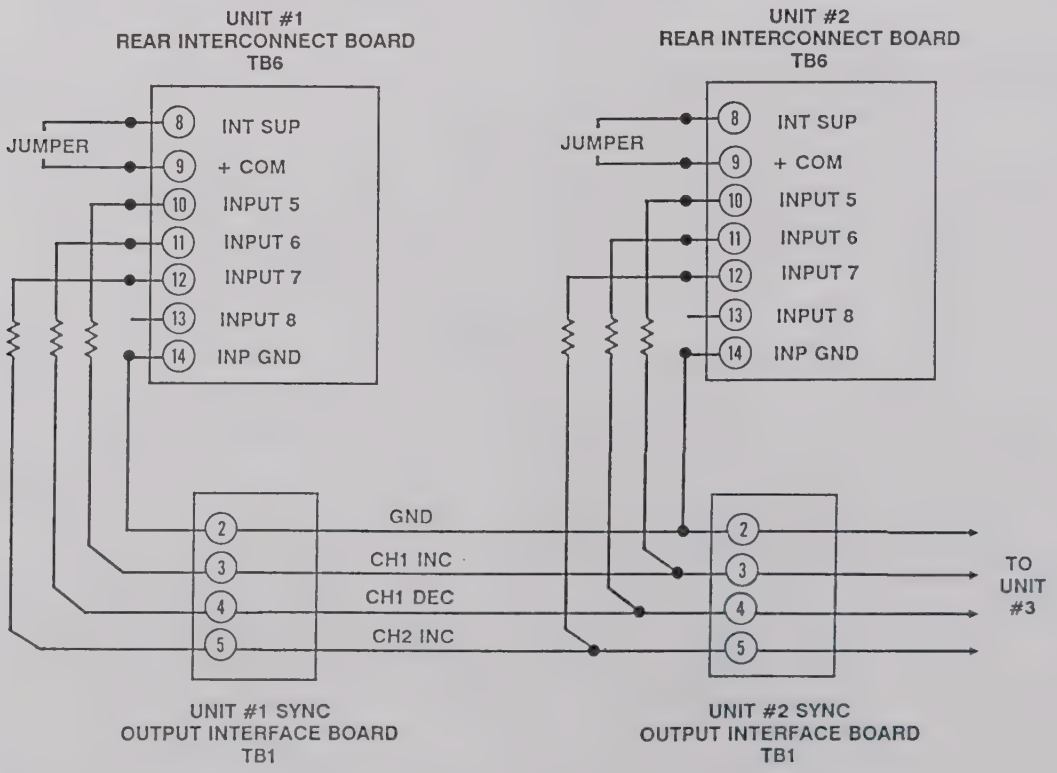


Figure 2-3. Connecting Synchronized Units

3. Programming Tutorials

This chapter presents two step-by-step programming examples that introduce basic and advanced features of the FastTRAC™ 620

All operations required to program and run the system are performed using the front panel keys and displays, which are explained in Chapter 1. There are no switches to set. Menus, prompts, and help messages guide you through each operation.

If you have not already reviewed Chapter 1, you will need to do so before starting this tutorial. As noted in Chapter 1, an experienced technician could probably use the FastTRAC™ 620 without referring to the rest of the manual. However, a quick run-through of the tutorials in this chapter will make it easier for you to use the FastTRAC™ 620, regardless of your experience.

3.1 PROGRAMMING TUTORIAL #1

3.1.1 Use the Worksheet to Plan a Program

Figure 3-1 shows a typical profile that demonstrates the basic features of the Model 620 FastTRAC™ programmer. The program assumes that the Model 620 factory settings have not been changed. Those significant to the example program are:

- standard two-channel controller operation
- in ° C
- span -80 to +180° C (260°)

Instructions on how to change these and other configuration parameters are provided in Chapter 6.

You will find it much easier to enter a program in the Model 620 FastTRAC™ if you first use a program worksheet to write down the program. This way, you can spot potential problems and correct them without backtracking through the Model 620 displays. Figure 3-2 shows the profile from Figure 3-1 entered on a sample worksheet.

In Paragraph 3.2, we will revise the program to introduce more advanced features. But for now, let's go through the program on Figures 3-1 and 3-2 step by step.

Step 1. Ramp from ambient to -50° in 15 minutes, 10° alarm deviation limit set. The Model 620 's soft start feature permits starting the program immediately from ambient. If a guaranteed ramp is desired, add a preliminary step to achieve the desired starting temperature.

Step 2. Soak at -50° for 15 minutes; alarm limits unchanged, no events turned on.

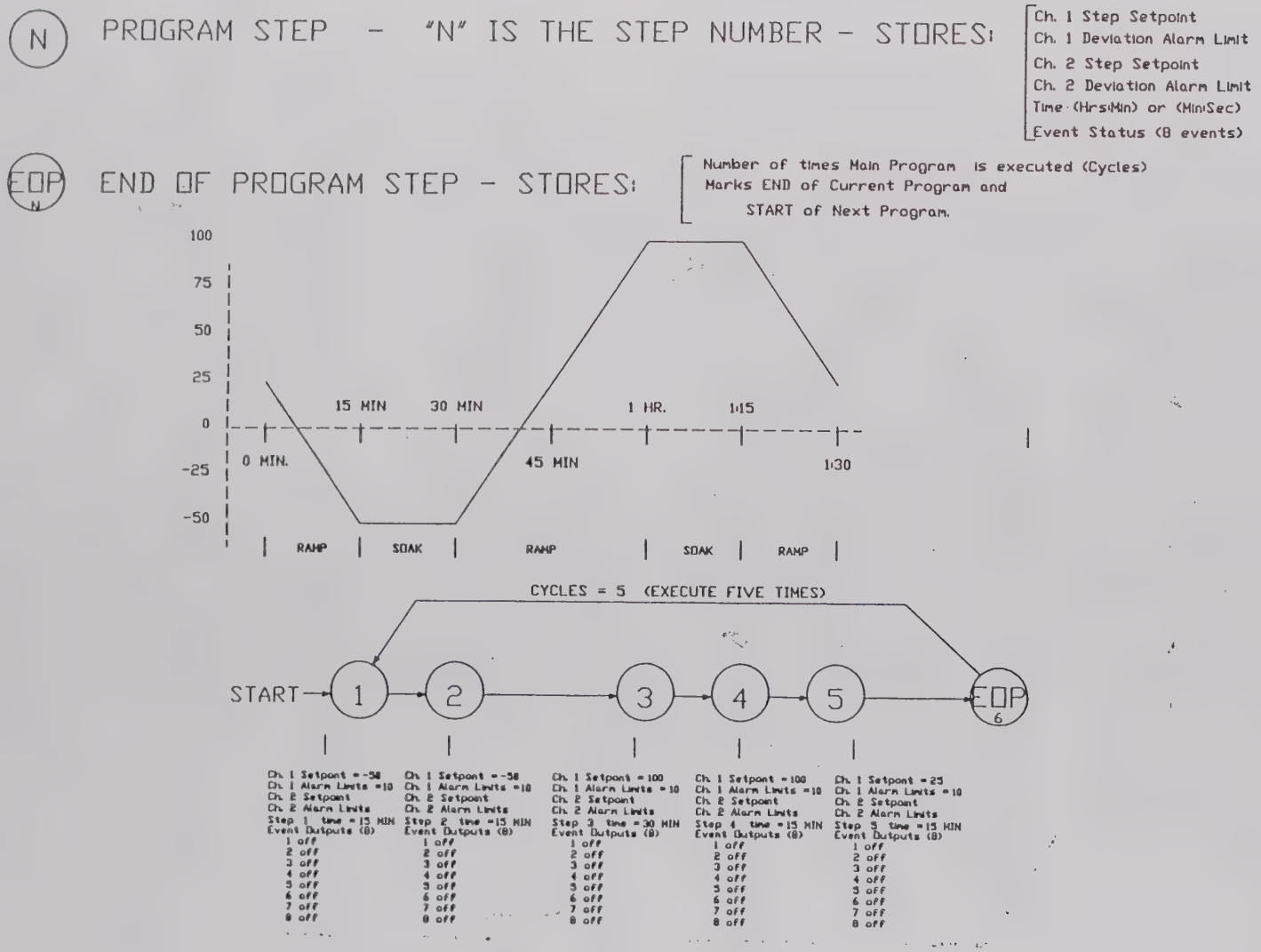


Figure 3-1. Profile for Sample Program 1.

NOTE: Encircled numbers correspond to step numbers shown on sample program worksheet.

MODEL 620 PROGRAM WORKSHEET — SINGLE/DUAL-CHANNEL

NOTE: Clearing the setpoint disables the controller for that channel.

PROGRAM NO. Tutorial #1 DATE 02/02/90

STEP	GUAR. SOAK		CHANNEL 1		CHANNEL 2		TIME			EVENTS								CYCLES/LOOPS/GOTO		
	GS1	GS2	SETPOINT	DEV. ALM +/-	SETPOINT	DEV. ALM +/-	HH	MM	SS	1 A	2 B	3 C	4 D	5 E	6 F	7 G	8 H	PRGM	STEP	# OF TIMES
1			-50	10	--	--	00	15	00											
2			-50	10	--	--	00	15	00											
3			100	10	--	--	00	30	00											
4			100	10	--	--	00	15	00											
5			25	10	--	--	00	15	00											
6			EOP		--	--														5

Figure 3-2. Worksheet for Sample Program 1.

Step 3. Ramp to 100° in 30 minutes; alarm limits unchanged, no events on.

Step 4. Soak at 100° for 15 minutes; alarm limits unchanged, no events on.

Step 5. Ramp to 25° (ambient) in 15 minutes. Alarm limits unchanged, no events on.

Step 6. Execute Program 5 Times and End Program. Note the 5 in the time column. This serves as a reminder that a 5 must be entered in the Cycles field of the EOP step, which will cause the entire program to execute 5 times. (More about that later in the example.)

3.1.2 Program Length

3.1.2.1 Program Length and Model 620 Program Storage Capacity

One complete program consists of all steps containing parameters and the EOP step. A program with nine steps is actually ten steps long (counting the EOP). Since the Model 620 FastTRAC™ can store a maximum of 200 steps, it has room for 20 programs each containing 10 steps total (9 steps plus the EOP step).

3.1.2.2 Importance of End-of-Program Step

The EOP has the following functions:

1. It marks the end of the program.
2. It specifies the number of times the program will be executed. A setting of 0 cycles produces an infinite loop.
3. It eliminates the need to cycle all the program. For example, you can use the first two steps to ramp to selected ambient conditions in the first step and condition the DUT in the second step. If you set the cycles to run starting with Step 3, the first two steps would only be performed on the first pass. Only the actual test portion of the program, Steps 3 and on, would be performed in the remaining passes.

3.1.3 Enter the Program at Model 620 Front Panel

Now that you have planned the program, it's time to enter it in the Model 620 FastTRAC™. For this first program, you will use Channel 1 only. The worksheet provides a place to enter each of the values you will program into the Model 620. The values are in the same order as the Model 620 screens will be accessed.

3.1.4 General Instructions

The sample program lists the applicable value from Figure 3- 1 and 3-2 in brackets [ ]. You could enter any similar program simply by substituting your own values.

3.1.4.1 Finding Buttons and Displays

Chapter 1 lists the location of and identifies front panel displays and buttons you will use to enter the program. Pressing RESET at any time takes you back to the STOP screen for the step and program you are editing.

Hint

To learn faster, use the Model 620 to key in
the example as you review the text.

3.1.4.2 Moving the Cursor

The cursor is a pointer, not only for the operator, but also for the Model 620 itself. The cursor position is marked by a blinking character block. The cursor always marks a single field — for example, the program number, or one of the events. On some screens, the cursor is disabled to prevent errors. On other screens, it will only move to "active" fields; that is, fields that the operator can change in some way.

To move the cursor between fields of the display (positions), use the arrow keys. In Edit mode (while entering or revising a program), moving the cursor out of a field causes the value in that field to be stored in the Model 620 program.

You can also store the value shown in a field and move the cursor to the next field by pressing the ENTER button.

When the program and step numbers are the only active fields (Select or Review Program modes), you can use the arrow keys to increase or decrease either number. In Edit mode, you must use the keypad.

3.1.4.3 Using Edit Keys

The Edit keys provide shortcuts for repetitive program tasks that are particularly useful when revising an existing program.

DUP STEP duplicates the current step as the next step in the sequence and advances the step number by one. The display remains on the same page it was on for the duplicated step. In other words, if you press DUP STEP while on the second page of Step 3, the display changes to the second page of Step 4. All later steps increase by one.

If you press the DUP STEP key more than once, you move to the same page of the last duplication.

CLR STEP removes all programmed information for the step being edited and sets the step type to Standard.

INS STEP inserts a Standard step without program parameters immediately following the currently displayed step. If the program is empty, the step is inserted as step 1 of the selected program number.

In either case, the display changes to the same page of the new step, and any later steps in the program are renumbered (remaining step numbers increased by one).

DEL STEP deletes the currently displayed step and renumbers all later steps in the program (decreases remaining step numbers by one). The step number displayed remains the same, but the settings are those of the next step in the original program. For example, if you delete Step 4, the new Step 4 will be displayed with the original settings for Step 5.

3.1.4.4 Checking Values

When you enter or change a value or selection, the display changes immediately to show your entry. Check the display before moving to the next field so you won't have to backtrack.

3.1.5 Programming Procedure

3.1.5.1 Step Types

Five types of steps can be programmed with the Model 620 as follows:

STD — A *Standard* step can be a ramp (starting at one temperature and moving to another within a specified period of time) or a soak (staying at the same temperature for a specified period of time).

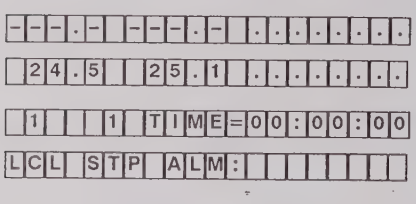
EOP — An *End Of Program* step marks the end of the program, or selects the beginning step number for a cycle and the number of cycles to be performed.

LOOP — A *Loop* step selects the beginning step number for a loop and the number of loops to be performed.

GOTO — A *Go To* step can go to any program and step number; therefore, it can be used to create an endless loop.

PAU — A *Pause* step latches the previous step information and wait for a Run command.

3.1.5.2 Access the Edit Mode



1. With the unit plugged in, press STOP to be sure you are in Stop mode. For a Model 620 fresh out of the box, the Stop mode display should appear as shown at left. The cursor appears in the Step field (4th through 6th positions) on the 4th line of the display.
2. Press PAGE DOWN to access the Main Menu.
3. Press 3 on the keypad to enter Edit mode. This is the only mode in which programs can be written or changed.

3.1.5.3 Program the First Step

1. Verify that the Edit page displays the program and step numbers set at 1. If not, either press INS STEP if the display reads "PROGRAM EMPTY", or enter the correct program number using the keypad.
2. Use the ↑ key to move the cursor to the Step Type field in the first line of the display. Press the SEL button until step type displays STANDARD.
3. Press the PAGE DOWN button. The cursor will be at the Channel 1 Setpoint field (after CH1 SP:_). Use the keypad to enter the desired setpoint [-50.0]. Leading zeros are assumed. If you do not enter the decimal point, the setpoint is assumed to be a whole number.

NOTE

If an **m** appears in the field, you are in Manual mode. Return to the Main Menu, select 5, and press SELECT to switch to PROGRAMMER.

4. Move the cursor to the Deviation Alarm Limit field (DEV) and use the keypad to enter the desired limit in degrees [10].
5. Move the cursor to the Step Duration field (TIME). (Skip CH2 or THERMOBOOST if shown.) Use the keypad to enter the desired step length [10 minutes, entered as 00:10:00].
6. No events are enabled in this step. Verify that the events displays on the 4th line all show either a decimal point (.) or an X. (The meaning of these symbols will be explained in the second example.)

3.1.5.4 Moving to the Next Step

- Pressing PAGE DOWN while on the second page of a step moves you to the first page of the next step. You must then enter the desired parameters in the same manner as described for Step 1.
- Pressing DUP STEP copies all parameters of the current step to a new step with the next higher number. You only need to enter those parameters that change in the new step. This is a real time-saver when you have a number of steps with similar values.

In this sample program, for example, to create the second step using the DUP STEP feature, proceed as follows:

1. From the last page of Step 1, press DUP STEP. The Step Number field will change to 2.
2. The setpoint [-50°], deviation alarm limit [10°], and the step duration [10 minutes] displayed for Step 2 are the same as those selected in Step 1.
3. Referring to Figure 3-1, you see that the required setpoints and deviation limits for Steps 1 and 2 are the same. Step 1 ramped to the setpoint of -50° in 10 minutes. Step 2 requires a 15-minute soak at that setpoint. So you only need to change the step duration.

4. Use the arrow keys to move to the Time field, press the → arrow key or the ./: key to move the cursor into the minutes column, and use the keypad to change the value from 0:10:00 to 0:15:00.
5. Press PAGE DOWN or DUP STEP as desired to continue programming with the next step.

3.1.5.5 Enter Additional Intermediate Steps

For each additional intermediate step in the program (up to the final end-of-program step), Only the parameters change as shown in Figure 3-1 and repeated here for reference. Enter values directly as explained for Step 1 (Para. 3.2.5.2) or use the DUP STEP button as explained in Para. 3.2.5.3.

Step 2. Soak at -50± 10° for 15 minutes.

Step 3. Ramp to 100± 10° in 30 minutes.

Step 4. Soak at 100± 10° for 15 minutes.

Step 5. Ramp to 25± 10° in 15 minutes.

3.1.5.6 Enter End-of-Program (EOP) Step

After all parameters for the first five steps of the program have been stored in memory, press PAGE DOWN to create Step 6 as a standard step with no parameters. 1. Move the cursor to the Step Type field on line 1 of the display.

2. Press the SEL key until EOP appears in the field display. Line 2 of the display will change to allow you to enter EOP information as follows:
   - In the Step Number field (STEP NO), use the keypad to enter the step number you want to cycle from [1, which repeats the entire program for the desired number of cycles]. Since 1 is the default value, move to the next field.
   - In the Cycle field (CYC), use the keypad to enter the number of cycles you want before the program ends [5]. The number is inclusive because the cycles counter decrements immediately before the EOP step. So 5 cycles include the first pass through all steps, plus 4 passes through the step that begins the cycle to the end of the program.
   - Note that no parameters are entered in an EOP step; its purpose is to mark the end of the program and cycle other steps if desired.
3. If you only wanted to run the program one time (no cycling), you would leave the cycle number set at 1, its default value.
4. Press PAGE DOWN. The display will return to Step 1 of the program you just entered. Then press PAGE UP to return to the Main Menu.

3.1.5.7 Program Cycles

The CYCLES selection contained in the EOP step makes it possible to repeat the entire program, or a portion of the program from any step to the end, as many times as desired. (One cycle equals one complete program execution.) Our sample program executes the complete program's heat/cool cycle five times. You can program as many as 9999 cycles with the EOP step. The cycle will execute the entire program as many times as necessary without using up valuable program memory.

3.2 PROGRAMMING TUTORIAL #2 — NESTED LOOPS

3.2.1 Using the Nested Loop Capability

With the first sample program above, you saw how you could use the EOP step to cycle the entire program several times. The nested loop capability enables you to do the same thing with selected portions of the program.

The second sample program adds such a loop. Now you are going to turn the power supply on and off 50 times within a program using a nested loop, and you are going to repeat the entire program 20 times. That means you're actually going to repeat Steps 2 and 3 a total of 1,000 times. Figure 3-3 graphically presents the program and its profile; Figure 3-4 is the worksheet for the program shown in 3-3.

3.2.2 Programming a Nested Loop

The sample program shown in Figures 3-3 and 3-4 incorporates two more Model 620 features: the nested loop and events programming. The following paragraphs explain these procedures.

3.2.2.1 Loop Location

The programmer will not start on any loop command step. If the RUN key is pressed while in such a step, the Model 620 remains on that step.

3.2.2.2 Loop Execution

A nested loop must contain its program steps in sequence. The beginning of the nested loop is marked by entering the beginning step number in the loop command step. The loop will return to the specified beginning step and execute the program steps within the nested loop until it executes the number of loops specified in the loop command step. An internal software counter keeps track of the number of loops completed. Then the program exits the loop and proceeds to the step immediately following the loop command.

You can have multiple levels of nested loops, one inside another. You can also exit the nested loop and jump to other parts of the program using a Go To command within the loop to cause another program, or portions of the same program, to be executed. This will be explained under the Go To command description.)

3.2.2.3 Loop Storage

Each loop command uses one program step, just like the EOP command. Up to the 200-step capacity of the programmer, a Model 620 program can contain as many nested loops as required.

3.2.3 Programming Procedure for a Nested Loop

For example two, labeled as Program 2, enter the nested loop shown in Figure 3-3 and 3-4 as specified below.

3.2.3.1 Entering Standard Steps

1. Access the Edit mode as described in Para. 3.2.5.1.
2. Set the Program Number to the desired number [2]. The prompt INVALID ENTRY PROGRAM IS EMPTY will flash. Press INS STEP to stop the prompt and access Step 1 for editing. The Step Number will automatically default to 1.
3. Enter the parameters for the first step in the same manner as described in Para. 3.2.5.2. The parameters are:

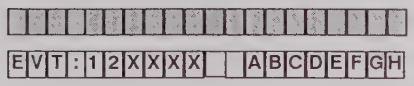
   [Channel 1 setpoint 150 °, alarm limits ± 10 °, time 30 minutes, no events].

4. Step 2 includes an event [1, which turns on the power supply of the device under test]. The step duration also changes from 30 to 10 minutes. You can enter the parameters for the

second step in the same manner as the first, then enable the event as described in Para. below. Alternately, you can press the DUP STEP key when you finish Step 1. Step 2 will be displayed with the parameters from Step 1. Then change the step duration and enable the event.

5. Step 3 is the same as Step 2, except that the event must be disabled as described in Para. 3.3.3.2 below. Enter step parameters using the standard or DUP STEP method, then disable the event.

3.2.3.2 Programming Event Status



Event status is displayed as two 8-position fields in the last display line as shown at left. The first field is for eight events numbered 1–8. The second field is for eight events lettered A–H. The status for each event is indicated in its position in the field as follows:

- Number (1-8) or letter (A-H) shown — event on
- . — event off
- X — Doesn't matter. (Event status is the same as it was for the last step.)

The display at left shows events 1 and 2 on, events 3-6 don't care, events 7 & 8 off, and events A-H all on. To change the status of an event, press the corresponding key on the keypad. Each push toggles the event to the next status in this order: on (number or letter displayed), off (⊖), or doesn't care (X). Use the arrow keys to move from one event field to the other. To clear all events for either channel, press CLR.

3.2.3.3 Entering a Loop Step

The next step of the program is the loop step, which is entered as follows:

1. Press PAGE DOWN to create the next step [4] with no parameters, then move the cursor to the Step Type field on line 1 of the display.
2. Press the SEL key until LOOP appears in the field display. Line 2 of the display will change to allow you to enter loop information as follows:
   - In the Step Number field (STEP NO), use the keypad to enter the step number you want the loop to begin on [2, which will turn the power supply on].
   - In the Cycle field (CYC), use the keypad to enter the number of times [10] you want the loop to repeat before proceeding to the next step of the program. When you run the program, Steps 2 and 3 will be performed 10 times.
   - Note that no parameters are entered in a loop step; its only purpose is to cycle other steps.

3.2.3.4 Enter Additional Intermediate Steps

There is only one additional intermediate step (up to the final EOP step) in the second example. The procedure is the same as for any standard step. Only the parameters change as shown in Figure 3-3 and repeated here for reference.

Step 5. Ramp to 25 ± 10 ° in 30 minutes.

3.2.3.5 Enter End-of-Program (EOP) Step

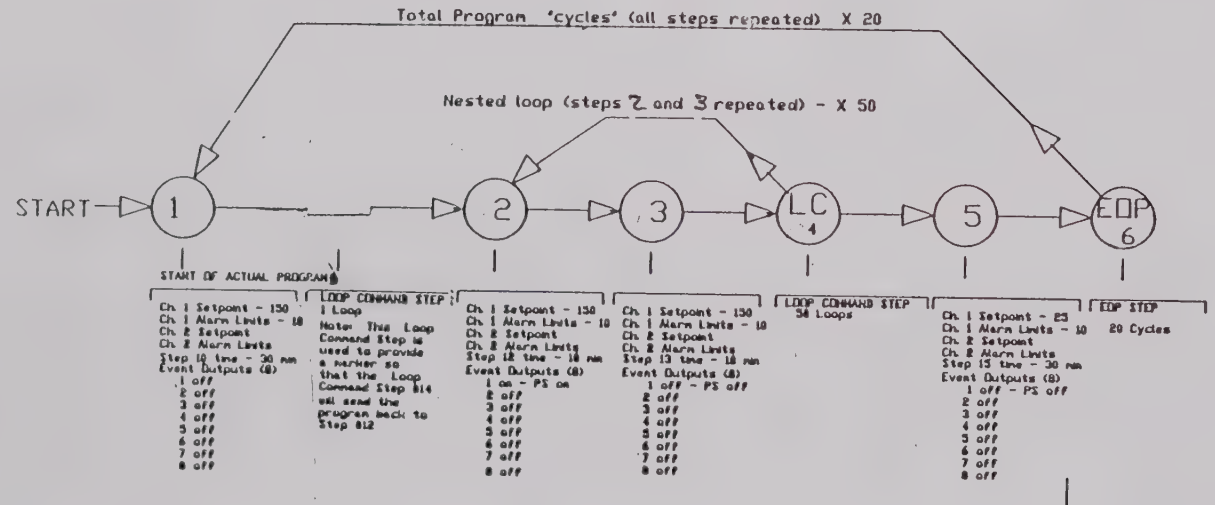
After entering Step 5, press PAGE DOWN. Step 6 will be displayed. Change the step type to EOP and enter the parameters as follows:

1. In the Step Number field (STEP NO), use the keypad to enter the step number you want to cycle from [1, which repeats the entire program for the desired number of cycles]. Since 1 is the default value, move to the next field.

(N) PROGRAM STEP - "N" IS THE STEP NUMBER - STORES:
- Ch. 1 Step Setpoint
- Ch. 1 Deviation Alarm Limit
- Ch. 2 Step Setpoint
- Ch. 2 Deviation Alarm Limit
- Time (Hrs:Min) or (Min:Sec)
- Event Status (8 events)

(LC N) LOOP COMMAND STEP - STORES:
- Number of times (loops) Nested steps are executed.
- Marks END of Nested Loop and START of Next section of nested program.

(EOP N) END OF PROGRAM STEP - STORES:
- Number of times Main Program is executed (Cycles)
- Marks END of Current Program and START of Next Program.



Note: This example is to demonstrate the power of the nested loop. The power supplies have to be turned on for 10 min. and off for 10 min. 50 times.

Channel 2 is ignored in this example

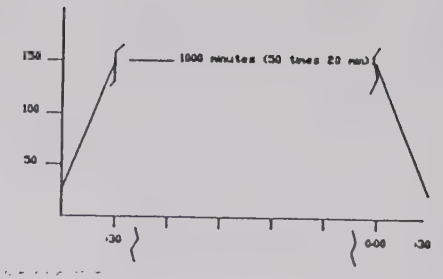


Figure 3-3. Profile for Sample Program 2.

MODEL 620 PROGRAM WORKSHEET — SINGLE/DUAL-CHANNEL

NOTE: Clearing the setpoint disables the controller for that channel.

PROGRAM NO. Tutorial #2 DATE 02/02/90

STEP	GUAR. SOAK		CHANNEL 1		CHANNEL 2		TIME			EVENTS								CYCLES/LOOPS/GOTO		
	GS1	GS2	SETPOINT	DEV. ALM +/-	SETPOINT	DEV. ALM +/-	HH	MM	SS	1 / A	2 / B	3 / C	4 / D	5 / E	6 / F	7 / G	8 / H	PRGM	STEP	# OF TIMES
1			150	10	—	—	00	30	00											
2			150	10	—	—	00	10	00	1										
3			150	10	—	—	00	10	00	X										
4			LOOP		—	—														50
5			25	10	—	—	00	30	00											
6			EOP		—	—														20

Figure 3-4. Worksheet for Sample Program 2.
6200290

2. In the Cycle field (CYC), use the keypad to enter the number of repeat cycles you want before the program ends [20]. (If you only wanted to run the program one time (no cycling), you would leave the cycle number set at 1, its default value.)
3. Press PAGE DOWN. The display will return to Step 1 of the program you just entered. Then press PAGE UP to return to the Main Menu.

3.2.4 Programming Guaranteed Soak

The Model 620 guaranteed soak feature will not allow timing for a soak step to begin until the process variable is within its setpoint ± the selected soak window.

The example programs above did not call for a guaranteed soak. To specify a guaranteed soak window, proceed as follows:

1. Access Edit mode and select program and step number.
2. Move the cursor to the guaranteed soak (GS) field for the desired channel (CH1 or CH2).
3. Use the keypad to enter the desired value, which can be 1 to 99. (0 defaults to OFF.)
4. To turn off a guaranteed soak, press 0 or CLR. The field display will change to OFF.

3.2.5 Programming a Pause Step

The Model 620 Pause feature enables you to stop the program before a predetermined step. The setpoint remains latched at the previous step's final setpoint value. Press RUN to resume the program.

The example programs above did not call for a pause step. To specify a pause step, proceed as follows.

1. Access Edit mode and select program and step number.
2. Move the cursor to the Step Type field on the first line of the display.
3. Press the SEL key until PAUSE is displayed in the Step Type field.

3.2.6 GoTo Steps

The Model 620 GoTo feature enables you to switch from any step of one program to any step of another program. The example programs above did not call for a GoTo step. To specify a GoTo step, proceed as follows.

1. Access Edit mode and select program and step number.
2. Move the cursor to the Step Type field on the first line of the display.
3. Press the SEL key until GOTO is displayed in the Step Type Field.
4. Press ENTER or use the arrow keys to move the cursor to the next field, which prompts for the program number you wish to go to. Use the keypad to enter the program number and press ENTER or move the cursor to the next field.
5. Enter the desired step number.

3.2.7 Programming for FastTRAC™ Operating Modes

See Chapter 4 for instructions.

3.2.8 Programming Multiple Synchronized Units

When programming synchronized units, enter programs with the same step duration for all units to be operated synchronously. If one programmer gets to the end of its step before the others, it will wait for the other programmers, and then all units will resynchronize before starting the next step. No unit will start until all units are ready.

3.3 STORE THE PROGRAM

No special procedure is required to store the program in the Model 620's internal memory. The program will remain in the Model 620's memory until you either revise it or write over it. (The battery backup's minimum five-year life will protect the program almost indefinitely, even with repeated shutdowns or power outages.)

3.4 REVIEW THE PROGRAM

You can review any step of a program at any time a program is not running. The displays in Review mode are the same as those in Edit mode, but the cursor is only active in the Program and Step Number fields. To review a step, proceed as follows.

1. Press STOP to enter Stop mode, then press PAGE DOWN to access the Main Menu.
2. Press 2 on the keypad to select Review mode.
3. Select the program and step number you wish to review. Use the arrow keys to move between the Program and Step Number fields. Use the ↑ or PAGE DOWN key to increase the program or step number, or the ↓ or PAGE DOWN key to decrease either of them. Alternately, enter the desired number on the keypad.

3.5 REVISE THE PROGRAM

You can revise any step of a program without having to redo the entire program. You also can change one or more values within the step without affecting values you don't want to change. In addition, you can either add or delete a step, and the remaining step numbers will increment or decrement as appropriate. The procedures for accessing and revising the step are the same as used for the original programming.

4. Running the FastTRAC™ 620

This chapter describes operations where all commands originate from a program in the Model 620's memory evoked from the front panel by the operator. No computer or external control signals are used, and the Model 620 is in the local mode (LCL displayed in the first field on line 4).

4.1 RUNNING A STANDARD 2-CHANNEL PROGRAM

This paragraph describes the procedure for running a program in the standard 2-channel programmer mode. Para 4.3 describes the differences when running FastTRAC™ modes.

4.1.1 Select the Program and Step Number

1. With the unit plugged in, verify you are in Stop mode (check the mode shown on the fourth line of the display).
2. If you want to run the currently displayed program and step, proceed to Step 4.
3. If you need to change the program or step number, press PAGE DOWN and 1. Then use the arrow keys to set the Program and Step numbers to the desired values. The other displays will change to reflect the current settings for the selected step.
3. Press RUN. The Mode field display will change to RUN and the step duration in the Time field will begin decrementing. The Model 620 will execute programmed controller operations without any further operator intervention.

4.1.2 Monitor Displays

In the Run mode, the Model 620 displays real-time current setpoints and process values, plus event status, for each channel on the first two lines of the display.

The second two lines show the program and step number, actual time remaining, operating mode (local, remote, or pause), and alarms (the displays for active alarms will blink).

LED's for each controller channel are located above (increase) and below (decrease) the CH1 and CH2 legends on the front panel. The appropriate LED will light whenever heating or cooling is in process.

Review the display to make sure it is correct before starting the run. Programming errors or equipment problems could cause the following error messages in the setpoint and process variable fields (beginning of display lines 1 and 2).

1. ---.-

Controller is off because a valid setpoint was cleared. The setpoint was entered, then the CLR button was pressed while the cursor was in the Setpoint field. This turns off the controller. Re-enter the setpoint correctly and either press ENTER or move the cursor to store the setpoint.

2. RANGE

The entered setpoint is outside the range allowed by the controller's span. Either change the setpoint or reconfigure the controller span (see Chapter 6).

3. P.OP

Probe open — the probe is disconnected, is defective, or has an open junction. Isolate and correct the problem.

4.1.3 Respond to Alarms

In addition to the displays resulting from error conditions described in the preceding paragraph, the Model 620 also displays alarm conditions. These signals flash on and off in the Alarm field (ALM) on the 4th line of the first Run screen. The channel is identified by its number (1 or 2) following the alarm condition code, which is:

- S for setpoint out of range or open probe
- L for process variable outside of selected deviation alarm limits

4.1.3.1 Respond to Invalid Setpoint Indication

If the *realtime* setpoint goes outside the operating range for the Model 620's controllers, the following actions occur.

1. The word RANGE appears in the Process Variable field of the display for the applicable channel.
2. The Code S1 or S2, as applicable, flashes in the Alarm field.
3. The Increase and Decrease outputs to the Output Interface Board TB1-3 and 4 (Channel 1) or -5 and -6 (Channel 2) are disabled.
4. The front-panel increase and decrease indicators do not light.
5. Program execution stops.

Take the following corrective actions as appropriate.

1. Check controller span and reconfigure if incorrect.
2. Move to Edit mode and revise the setpoint to one within Model 620 limits, then restart.

4.1.3.2 Respond to Deviation Alarm

When the *process variable* is outside the range allowed by the selected alarm limits, the following actions occur.

1. The Code L1 or L2, as applicable, flashes in the Alarm field.
2. The alarm output to the Output Interface Board at TB1-7 (Channel 1) or -8 (Channel 2) goes low.

3. If the programmer is configured to stop running when an alarm occurs (the factory setting, see Chapter 6 to change), the Time display stops decrementing to indicate that the program has stopped.
4. If the programmer is configured to continue running during an alarm, the Model 620 will continue running even through alarm limits have been exceeded. Depending on programmer configuration (see Chapter 6), the alarm outputs will either latch on (continue) or automatically reset (turn off, the factory setting) when the process variable returns to a point within limits.

4.1.3.3 Reset Action

If automatic reset is enabled, the Model 620 will automatically resume operation and the alarm outputs will be automatically reset as soon as the out-of-limits condition has ended. If automatic reset is disabled, alarm actions continue until parameters return within limits and the Run mode is again enabled.

4.1.3.4 Respond to Probe Open Indication

If a probe is defective, disconnected, or has an open junction, the following actions occur.

1. The code P.OP appears in the Process Variable field display.
2. The alarm output is activated.
3. Program execution stops. Press STOP, correct the error condition, and press RUN to resume program operation.

4.2 RESTART PROGRAM

4.2.1 Soft Start.

This feature can be used to abort and restart a program without thermal stress to the device under test. Soft start is the factory setting for restart mode; see Chapter 6 for instructions on disabling soft start.

For soft start to work, the step selected for restart either must be for a nonzero time (time other than 0:00), or for a guaranteed soak. The soft start feature calculates a ramp from the process temperature to the programmed temperature based on time allotted for a step.

When soft start is not enabled, the beginning setpoint at restart is the final setpoint of the previous step. The controller ramps to the programmed setpoint for the current step.

4.2.2 Restarting at Ramp or Soak Step (XX:XX:XX STEP TIME)

When the Model 620 is started from any program step with a non-zero time, the soft start is invoked as follows.

1. The Model 620 reads the actual process temperature and uses that temperature as the starting setpoint for that step.
2. The Model 620 then takes the process temperature to the programmed value at a linear rate over the time programmed for the ramp.
3. If the program is stopped for any reason, the timer stops and the present process temperature is latched and maintained.

4.2.3 Restarting Without Ramp or Soak (00:00:00 STEP TIME)

If the restart step is not programmed as a guaranteed soak, the programmer will immediately advance to the next step. Otherwise, the Model 620 will supply the controller(s) with the setpoint stored for the restart step and the system will go to the programmed temperature at the maximum possible rate.

4.3 USING FastTRAC™ 620 OPERATING MODES

In the Standard FastTRAC™ mode of Model 620 operation, the Channel 1 controller, called the primary loop, reads the actual part temperature, compares this input with the desired setpoint, and generates a desired chamber air setpoint for Channel 2, the secondary loop. Channel 2 then uses this setpoint to control chamber air heating and cooling. To avoid rewiring of air temperature control when using this mode, the Channel 2 outputs are internally redirected to the Channel 1 outputs.

NOTE

As soon as FastTRAC™ mode is selected when configuring the programmer, Channel 2 units automatically switch to match Channel 1 units. Once the FastTRAC™ display appears on the program mode screen, the Channel 2 units can be reset to the original setting only as described in Para. 6.4.1.

In pass-through mode, the primary loop controller setpoint is not modified by firmware and is passed directly to the secondary loop. In this case, the unit functions as a single-channel, standard air temperature control system.

The ThermoBoost™ and boost limit features are active only in Standard FastTRAC™ mode.

4.3.1 Connecting the Controllers

Figure 4-1 shows the general arrangement of a typical FastTRAC™ system. Temperature inputs are connected at the Rear Interconnect Board as shown in Figure 4-1. The DUT sensors connect to the Channel 1 input (TB1-3 & -4). The air temperature sensors connect to the Channel 2 input (TB1-5 & -6). Note that there are no external outputs from Channel 2 to any device. Channel 2 output signals are internally redirected to the Channel 1 output control circuitry.

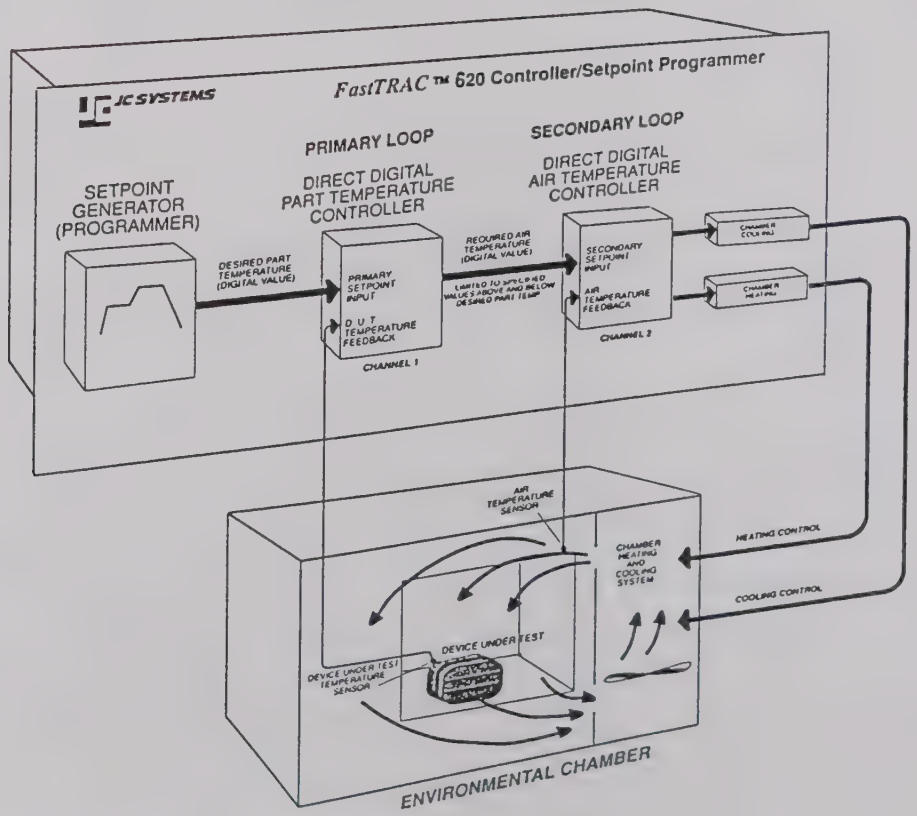


Figure 4-1. FastTRAC™ General Arrangement.

4.3.2 Generating a Setpoint

A FastTRAC™ 620 will accept instructions from its programmer to automatically adjust the air temperature setpoint. Note that only Channel 1 can be programmed when the FastTRAC™ system is enabled.

4.3.3 Determining the Current Operating Mode

There are two ways to determine the current operating mode.

1. In Run mode, press PAGE DOWN twice and check he 3rd line of the display, which will read:
   - FASTRAC if the unit is in standard FastTRAC™ mode;
   - PASS THRU if the unit is in FastTRAC™ pass-through mode, or,
   - 2-CHANNEL if the unit is set for operation as a standard 2-channel controller.
2. Enter programmer configuration as described in Chapter 6 and review or revise the operating mode as desired.

4.3.4 FastTRAC™ ThermoBoost ™

NOTE

The ThermoBoost™ feature functions only in Standard FastTRAC™ mode. It is inactive in Passthru mode.

Independent ThermoBoost™ values ranging from 0-99 can be set for HOT and COLD. These values specify the maximum allowable difference between the programmed setpoint and the air temperature setpoint generated by Channel 1. To set ThermoBoost™, proceed as follows.

1. From the Stop menu, press PAGE DOWN to access the Main Menu.
2. Press 3 on the keypad to select Edit mode.
3. Press PAGE DOWN once. The second line of the display now shows the ThermoBoost™ values in the Hot and Cold data fields.
4. Use the arrow keys to move to the desired field, then enter the desired value.
5. If desired, repeat Step 4 for the other value.
6. Move the cursor or press ENTER to store the last value.

4.3.5 FastTRAC™ Temperature Limits

NOTE

The FastTRAC™ temperature limits feature functions only in Standard FastTRAC™ mode. It is inactive in Passthru mode.

FastTRAC™ low and high temperature limits can be set to any value between -99 and 537.7°C (-147.8 to 999.9°F) as described in Chapter 6. This range of values permits bracketing the Channel 2 air temperature setpoint at absolute maximum and minimum values regardless of the Channel 1 setpoint and ThermoBoost™ settings.

4.3.6 FastTRAC™ Displays

In the FastTRAC™ mode, the Channel 1 Setpoint field displays the programmed setpoint and the Channel 1 Process Value field displays the real-time part temperature. The Channel 2 Setpoint field displays the air temperature setpoint being generated by the primary loop. The Channel 2 Process Value field displays the air temperature in the chamber.

4.3.7 FastTRAC™ Tuning

Special tuning (adjustment of proportional, integral, and differential settings) may be required for controllers using FastTRAC™ technology. Refer to Appendix A.

4.4 OPERATION AS A MANUAL CONTROLLER

You can disable one controller and operate the other in Manual mode, or run one controller in Programmed mode and the other in Manual mode. Manual operation as a two-channel controller is described first. The special requirements for manual operation in FastTRAC™ mode are then explained.

4.4.1 2-Channel Controller Operation

4.4.1.1 Entering Manual Mode

1. From the Stop screen, Press PAGE DOWN to access the Main Menu.
2. Press 5 on the keypad to enter the Manual mode. If you were previously in Run mode, the programmed setpoint for the channel to be placed in Manual mode will remain latched until you select Manual mode.
3. Use the arrow keys to move the cursor to the desired channel, then press SEL to change the channel input displayed on line 3 or 4, as applicable, from PROGRAMER to MANUAL DEV =. The setpoint display for the selected channel will change to ——.–, prompting you to enter the setpoint desired for Manual operation.

4.4.1.2 Entering the Manual Setpoint

4. Move the cursor to the applicable Setpoint field in the first line of the display. Use the keypad to enter the desired setpoint. After you enter the setpoint, the letter **m** will replace the decimal in the setpoint field to indicate that you are now in Manual mode.

   If you do not enter a setpoint, the channel will be disabled and the display will continue to show – – – . –. This will turn off the controller outputs.

4.4.1.3 Enabling Events in Manual Mode

1. Set both channels in Manual mode.
2. Move the cursor to the desired position (event number or letter) in the applicable Event field and use the keypad to change event status as required. Events will remain in the selected status until you leave Manual mode and run a program.

4.4.1.4 Setting Deviation Limits for Manual Mode

Move the cursor to the Deviation field (DEV=) on line 4, then use the keypad to enter the desired value (0-55).

4.4.1.5 Selecting Manual Control of Percent Output

The Manual Percent Output feature allows you to set the selected controller's time or power proportioning output to a fixed percentage.

The Model 620 incorporates an automatic safeguard to prevent damage to a DUT or system that could result if a controller is left in manual percent output. Whenever you leave the % OUTPUT display page, percent output immediately reverts to Manual mode with the setpoint cleared (no output).

1. To access the percent output display page, first place one of the controllers in Manual mode, then press PAGE DOWN. The characters at the beginning of lines 3 and 4 change from CH to C% to indicate that percent output can be selected.

NOTE

If you press PAGE UP to leave this screen when one channel is in %OUTPUT, both controller channels will automatically revert to Manual mode with no set-point. You must reenter a valid manual setpoint before you can run a program.

2. Move the cursor to the desired channel and press SEL to select %_OUTPUT. If you chose Channel 2, the line 4 display would change to read C%2_ %_OUTPUT and the Channel 2 setpoint would change to 0.
3. Move the cursor to the selected channel's Setpoint field on line 1. Then use the keypad to enter the desired constant percent output (both time proportioning and analog). Selecting 0 to 100 will produce that percent output for heat (INC); selecting 0 to -99 will produce that percent output for cool (DEC).

4.4.1.6 Exiting Manual Mode

To exit Manual mode, press SEL to change back to PROGRAMER, then press RESET to return to the Stop screen. The manual mode setpoint remains latched.

You can leave either channel in manual mode so you can run an existing program on one channel and a fixed manual setpoint on the other. To do so directly from Manual mode, press RESET to return to the Stop screen, then press RUN. While the program is running, the setpoint for the channel in manual mode will show the letter "*m*" in place of the decimal point.

4.4.2 Using FastTRAC™ in Manual Mode

Standard FastTRAC™ operation in Manual mode enables you to use a fixed manual setpoint for FastTRAC™ control and run a program as a time/events sequencer. However, when you use Standard FastTRAC™ operation in Manual mode, there are stringent requirements to ensure proper operation.

1. You must set up for FastTRAC™ operation in Manual mode by first creating and running a simple 2-step program as follows:
   a. The first step contains a setpoint equal to the current Channel 1 process variable and the ThermoBoost™ values you want to use in FastTRAC™ Manual mode. Set time to 10 seconds. This step is necessary because boost can only be entered in the Edit mode.
   b. The second step is the EOP.
   c. Once you have entered the program, press RUN to place the selected values in programmer memory.
2. After running your two-step prgoram, press STOP, PAGE DOWN, and 5 to acess the Manual mode screen.
3. Place *Channel 1 only* into Manual mode. Leave Channel 2 in Programmer mode.

NOTE

If you put Channel 2 in Manual mode too, Channel 2 stops outputting a setpoint and shows only dashes. Controller outputs stop because Channel 2 is not generating a FastTRAC™ output. (See Step 5 for recovery procedure.)

4. Move the cursor to the setpoint field and enter the desired value. The Model 620 will control that setpoint in FastTRAC™ mode.

NOTE

If you require a deviation alarm, be sure to set it on Channel 1. The Channel 2 deviation alarm does not function in FastTRAC™ mode.

5. If you inadvertently place Channel 2 in Manual mode as well, recover as follows:
   a. Return Channel 2 to Programmer mode (Channel 1 can stay in Manual), then press RESET to return to the Stop screen.
   b. Run the 2-step program again to reset FastTRAC™ parameters.
   c. Proceed with manual FastTRAC™ operation.

4.4.3 Delayed Start

You can program a delayed start for any program and any step of that program as follows.

1. From the Stop mode, press PAGE DOWN to access the Main Menu.
2. Press 6 on the keypad to select DLY START.
3. Press SELECT to switch delayed start on.
4. If the desired program or step number is different than the one displayed, use the keypad to select the program number, then use the arrow keys to move to the Step Number field. You can enter the step number using the arrow keys or the keypad.

CAUTION

Delayed start always runs the currently displayed program and step. Leave the Delayed Start screen displayed to avoid inadvertently changing to a different program or step number. If you must leave the Delayed Start screen, press STOP, clear the Time field, and press RESET to cancel delayed start. When you are ready to run delayed start, begin again with Step 1 above.

NOTE

If you see an INVALID ENTRY prompt, press ENTER to recover, or use the keypad to make a valid entry.

5. Move to the Delay Time field on the 3rd line and use the keypad to enter the desired time in HOURS:MINUTES:SECONDS, maximum 99:59:59.
6. Press:
   - ENTER and RUN to start the clock. The clock will decrement to 00:00:00 hrs/min/sec, then the program will begin running.
   - STOP to stop the clock and RUN to resume.
   - RESET to return to the STOP screen without resetting the clock. The program will start when the clock decrements to 00:00:00.
   - STOP, clear Time field, and then press RESET to cancel the delayed start.

5. Remote Programming and Operation

5.1 INFORMATION PROVIDED

This chapter describes how to interface a remote computer to the Model 620 FastTRAC™ and then enter, run, and monitor programs. The Model 620 understands and responds to commands from a remote computer in the same manner as though you were entering the command directly into the Model 620 front panel. (You may want to review Chapter 3 before using the information in this chapter for the first time.) You can use any standard communications software — such as ProComm or ProComm Plus — in VT-100 terminal emulation mode to communicate with software resident in the Model 620 FastTRAC™.

Note that the RS-232C and RS-422A/485 serial interface capabilities are standard on any Model 620, while the IEEE-488 (GPIB) interface is available as an option. If your unit is equipped with the IEEE-488 interface, it will have an IEEE connector installed on the Output Interface Board (Figure 5-1).

When the FastTRAC™ 620 is properly configured for remote operation, all remote interfaces enable you to:

- monitor Model 620 status from the remote computer;
- change controller tuning parameters "on the fly", and
- download the Model 620 program to the remote computer's memory.

Other specific interface capabilities will be described in the detail paragraphs below.

5.2 OPERATING WITH EXTERNAL CONTROL INPUTS

The Model 620 accepts externally generated inputs for program RUN, STOP, and RESET. Connect external RUN, STOP and RESET control signals at appropriate terminals of TB6 on the Rear Interconnect Board (Figure 5-2). (See Table 5-1 for terminal assignments.) Note that the photoisolator source voltage (TB6-2) must be connected to a +5V power supply, with the power supply negative (-) connected to TB6-7 internal ground.

You can also use the Model 620's internal 9Vdc, 50 mA supply (TB6-1). In this case, you must install a 300-ohm resistor in series between TB6-8 (a second 9Vdc internal supply) and TB6-9 (+ common) to provide +5Vdc to the photoisolator source. Do not jumper the pins together.

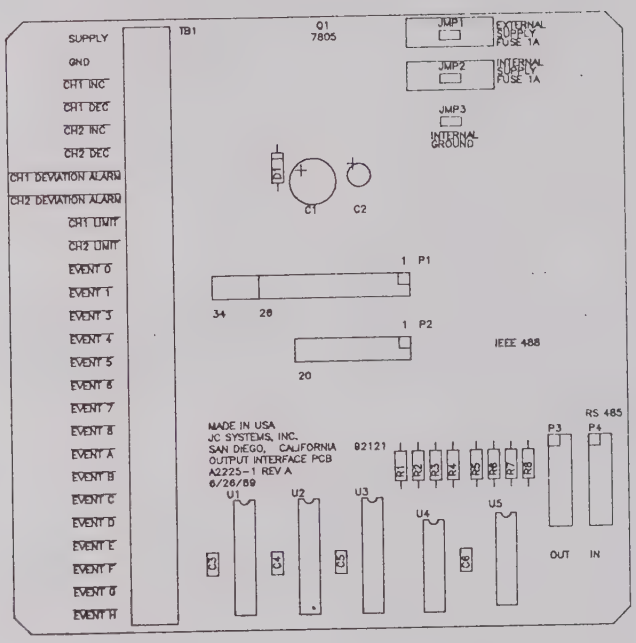


Figure 5-1. Output Interface Board.

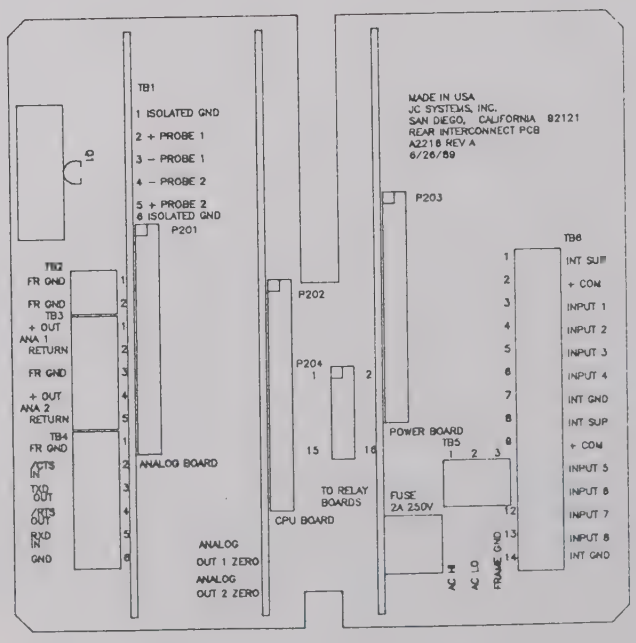


Figure 5-2. Rear Interconnect Board.

TABLE 5-1: EXTERNAL CONTROL SIGNAL CONNECTIONS

TB6 PIN NO.	FUNCTION
1	+ 9 Vdc unregulated
2	+ Com
3	RUN (Input 1)
4	STOP (Input 2)
5	RESET to start of program (Input 3)
6	Front panel lockout (Input 4)
7	Com (0 Vdc)
8	+ 9 Vdc unregulated
9	+ Com

If the internal power supply is used, connect TB6-3, -4, or -5 to TB6-7 momentarily to actuate the RUN, RESET, or STOP functions, respectively. There is no external isolation in this case.

If an external 5V power supply is used, actuate the RUN, RESET, or STOP function by momentarily connecting TB6-3, -4, or -5 to the negative (-) output of the external power supply. No connection should be made to TB6-1 if external isolation is desired.

5.3 FRONT PANEL LOCKOUT

5.3.1 Discretionary Lockout

In Remote operation, when the Model 620 is in Stop mode, you can use the 620's front panel controls to switch it from remote to local operation, then add or change programs. If you want the ability to lock out the front panel entirely during remote computer operation, enable the internal source voltage and connect a keyswitch between TB6-6 (Input #4) and TB6-7. When the keyswitch contacts are closed, the Model 620 front panel is disabled.

5.3.2 Computer Lockout

In Remote operation when the Model 620 is in Run mode, you can only use the front panel controls to review program displays. If the computer fails or communications are disrupted while in Remote Run, you need to stop the program to regain local control of the Model 620. To do this, the internal source voltage must be enabled with a 300-ohm resistor installed in series between TB6-1 and -2. Then temporarily connect TB6-4 (Input #2, STOP) to the isolated ground, TB6-7.

5.4 REMOTE MONITORING OR OPERATING OF THE MODEL 620

The Model 620 offers two remote communication/operation options.

5.4.1 Local Operation

In Local operation, you can operate the system from the front panel in the normal manner and *monitor* program parameters and current values from a remote computer. All front panel displays and operations are exactly as described in Chapters 3 and 4. You cannot change any parameters from the remote computer in Local operation, but you can review any program and step.

5.4.2 Remote Operation

In Remote operation, All Model 620 programming and operating can be controlled by commands from the interfaced computer. The front panel shows all displays and current values or settings in the appropriate positions. The way those displays are accessed and values changed will vary in Remote operation as follows.

5.4.2.1 Reviewing Programs

In Run mode during Remote operation, only the front panel PAGE UP, PAGE DOWN, and HELP keys function, and only to access the review screens. In Stop mode during remote operation, you can access all screens from the front panel for review, but you cannot ***change*** program parameters unless you first switch from Remote to Local operation view the programmer configuration menu.

If you wish to review a program or step other than the one currently selected, you must use the arrow keys to move the cursor to the program or step number, then use the keypad to enter the number you wish to review.

5.4.2.2 Changing Parameters

Unless you lock out the front panel as described in Para. 5.3.1 above, when the Model 620 is in Stop mode during Remote operation, you can modify ***any*** program from the front panel.

If you use the remote computer to change a parameter, that change will not be displayed immediately on the Model 620 front panel. The new setting will be displayed after you move to another screen and return.

5.4.3 Configuring for Remote Monitoring or Operating

1. From the Stop menu, press PAGE DOWN to access the Main Menu, then press 4 to select the Config-Tune-Calib.
2. If the screen prompts for the access code, refer to Chapter 6 for instructions. Otherwise, press 1 to select programmer configuration.
3. When the display changes, the cursor will be on the Interface Type field (TYPE). Press SEL to toggle on the desired interface. The available interfaces are RS-232, RS-422A/485, or IEEE-488, which functions only if the IEEE-488 interface option is installed.
4. If you are enabling the RS-422A/485 or IEEE-488 interface, move the cursor to the next (Address Number) field and use the keypad to enter the address of this programmer only. (Each programmer in an IEEE-488 or RS-422A/485 loop must be assigned its own address.) Possible addresses are from 1 to 99.

NOTE

The user will need assigned addresses to communicate command and status information from the master computer to party-line Model 620's. Therefore, an address chart posted near the computer showing the address and location of each Model 620 on the network might prove useful in some applications.

5. Move the cursor to the Baud Rate field (BAUD) on line 4 and press SEL to select a baud rate for serial communications. Standard rates from 300 to 34,000 baud are selectable.
6. Move the cursor to the next (Parity) field and press SEL to select desired word length and parity for serial communications from the following: 7-bit even, odd, mark or space, and 8-bit no parity.

NOTE

Be sure the communications parameters for your software match those entered in Steps 5 and 6.

7. Use the arrow keys to move the cursor to the current operating mode field in the third line of the display. Then press SEL to toggle from FRONT PANEL to EXT COMPUTER.
8. Move the cursor or press ENTER to store the last value.
9. To exit programmer configuration, press PAGE UP until you reach the Stop screen.

5.5 REMOTE COMMANDS

Use the command set listed in Table 5-2 for all communications between a remote computer and the Model 620. The table is organized functionally. Appendix B contains a listing of the commands in alphabetical order. The syntax for remote commands is as follows.

5.5.1 The Basic Command

The basic command is a 3-character ASCII string, such as "RUN", "INS", or "SP1". There are three types of commands, as follows.

1. A **query** command asks for a current value or setting. For example, to read the current setpoint on Channel 1, send the ASCII string "SP1". To then read the time remaining in the current step, send the ASCII string "TIM". The 620 will transmit the requested data immediately upon receipt of the command code. The computer must read (input) the data into a string variable. A query command always consists of only three characters.
2. An **operating** command causes the Model 620 to perform some operation. For example, to begin a profile, send the ASCII string "RUN". Some operating commands use additional characters, called *arguments*, which are explained below, to send more specific instructions.
3. An **editing** command generates or revises a stored program parameter. It usually consists of a basic command followed by the desired parameter value given as one or more *arguments* (see below). "SS1 25", for example, would change the setpoint for the current step on Channel 1 to 25 degrees.

   Some editing commands consist of only three characters; for example, the commands to insert ("INS") or delete ("DES") a step in the current program.

5.5.2 Arguments

An *argument*, a term borrowed from computer programming, is a variable data portion of a command. For example, in the command "SS1 25", 25 is the argument that tells the Model 620 to set the current step setpoint to 25°.

Arguments must be separated from the basic command by a space or a colon (:). Where more than one argument is transmitted with a single command, the arguments must usually be separated by a *delimiter* — either a space, comma, or colon, for the Model 620. For example, the command "LOP 5,3" (or "LOP 5 3" or "LOP 5:3") sets the numbers of cycles (5) and the step the cycle begins on (3). In this case, the 3 and 5 are both arguments, separated from the basic command by a space, and from each other by either a comma, space, or colon.

The only arguments that do not use delimiters are used with the PID command to select the channel, function (heat or cool) and staging (staged or unstaged). (See *Revising PID Parameters* in Table 5-2.)

5.5.3 Response to Commands

After you enter a remote command, the Model 620 will respond in one of the ways described below. Every response is followed by a line feed.

5.5.3.1 Acknowledgement

When you enter an operating or programming command, the Model 620 acknowledges that the command has been executed with the letters "OK".

5.5.3.2 Question Mark

If the command was not entered correctly, or if the command cannot be executed in the current environment, the Model 620 will respond with a question mark (?).

5.5.3.3 Parameter Response

A parameter response shows the current value or setting in numeric form; for example, 75.0 for current setpoint. When a parameter has been cleared (for example, a setpoint for Channel 2 when that controller is not in use), the display will read "– – –". When no parameter has been set, the Model 620 will respond with a question mark (?).

5.5.3.4 Mode Response

A mode response shows a 3-letter abbreviation for the mode; for example, RUN for running, PAU for paused, STP for stopped, or EOP for end of program.

5.5.3.5 Alarm Condition Response

The alarm condition response is an ASCII string consisting of the alarm code and channel for each alarm. For example, if both alarms were active on both channels, the response would read, "S1L1S2L2".

TABLE 5-2: 620 REMOTE COMMANDS

NOTE

When an argument is shown as a capital letter in boldface (**P** or **S**, for example), enter that letter. When a command or argument includes a lower case, italicized letter *n*, substitute the desired numerical value. When an argument includes a lower case, italicized letter *x*, substitute the desired alphabetical character. A subscript number ($_1$ or $_2$) indicates when more then one argument can be used.

Command	Description
Interface Commands	
# *nn*	Sets unit ADDRESS (488 & 485 ONLY)
DLD, **P**	Downloads PID parameters from remote to 620
DLD, **S**	Downloads STEP parameters from remote to 620
IFS	Returns Interface Status (returns LCL or RMT)
LCL	Sets LOCAL mode (from REMOTE)
RMT SELECT	Sets REMOTE Mode (from local)
RQD	Disables IEEE service request
RQN	Enables IEEE service request
ULD, **P**	Uploads PID parameters from 620 to remote
ULD, **S**	Uploads STEP parameters from 620 to remote
Operating Commands	
RES	Resets stopped program — Sets current step to 1 and time to zero)
RUN	Runs current PROGRAM and STEP
RUN *n*	Runs selected PROGRAM number
RUN n_1, n_2	Runs selected PROGRAM n_1 and STEP n_2 number
STP	Stops program currently running
Reading Current Controller Values and Program Settings	

NOTE

Also see *Manual Mode Commands* and *Revising PID Parameters* below.

AEV	Returns ACTUAL EVENTS On/Off
ALM	Returns Current ALARM STATUS S1L1S2L2 or ————
CH*n*	Returns Mode (PRG, MAN, PCT) for selected channel *n* (1 or 2)
CL*n*	Turns OFF selected channel *n* (1 or 2) for this step
CTG	Returns the number of CYCLES to go
CSN	Returns current POINTER STEP NUMBER
EVN	Returns EVENTS On, Off, Dont Care

FTH	Returns FastTRAC HI TEMP Limit
FTL	Returns FastTRAC LO TEMP Limit
GS *n*	Returns GUARANTEED SOAK Value for selected channel *n* (1 or 2)
GTO	Returns GOTO Program and Step
HL *n*	Returns HI PROCESS LIMIT for selected channel *n* (1 or 2)
LL *n*	Returns LO PROCESS LIMIT for selected channel *n* (1 or 2)
LOP	Returns number of LOOPS and LOOP to STEP
LTG	Returns remaining CYCLES (in loop or EOP step)
MOD	Returns current RUN State (DLY, RUN, STP, OFF, PAU)
PR *n*	Returns Current Process Variable for selected channel *n* (1 or 2)
PRN	Returns current edit PROGRAM NUMBER
SP *n*	Returns current *control* Setpoint for selected channel *n* (1 or 2)
SS *n*	Returns current *programmed* Step Setpoint for selected channel *n* (1 or 2)
STM	Returns PROGRAMMED STEP TIME (HH:MM:SS)
STN	Returns current edit STEP NUMBER
TBD	Returns ThermoBoost DECREASE Value
TBI	Returns ThermoBoost INCREASE Value
TIM	Returns TIME REMAINING IN STEP (HH:MM:SS)
TYP	Returns STEP TYPE: STD — STANDARD (RAMP/SOAK) GTO — GOTO EOP — END OF PROGRAM LOP — LOOP PAU — PAUSE

Manual Mode Commands

CH*n*	Returns Mode (PRG, MAN, PCT) for selected channel *n* (1 or 2)
CH*x* **M**	Sets selected channel *n* (1 or 2) to MANUAL MODE
CH*x* **P**	Sets selected channel *n* (1 or 2) to PROGRAM MODE
MAn_1 n_2	Sets selected channel n_1 (1 or 2) Manual DEVIATION ALARM to n_2 (Zero is OFF)
MA*n*	Returns Manual Alarm for selected channel *n* (1 or 2)
MEC	Clears all MANUAL EVENTS to OFF
MEF $n_{1\text{-}8}$,$x_{A\text{-}H}$	Turns OFF specified MANUAL EVENTS
MEN $n_{1\text{-}8}$,$x_{A\text{-}H}$	Turns ON specified MANUAL EVENTS
MSn_1 n_2	Sets selected channel n_1 (1 or 2) Manual SETPOINT to n_2

Revising/Generating Program Parameters

NOTES

1. To read the *current* value or setting for any parameter, omit any arguments (*n* or *x*) from the command.
2. Also see *Revising PID Parameters* below.

AL *n*	Returns Deviation Alarm Limit for selected channel *n* (1 or 2): – – – for channel disabled; OFF for Deviation Alarm Off
AL *n* 0	Turns OFF DEVIATION ALARM for selected channel *n* (1 or 2)
AL n_1 n_2 (exc.0)	Sets selected channel n_1 (1 or 2) DEVIATION ALARM to n_2
CH *n* **M**	Sets selected channel *n* (1 or 2) to MANUAL MODE
CH *n* **P**	Sets selected channel *n* (1 or 2) to PROGRAM MODE
DEP	Deletes current EDIT PROGRAM
DES	Deletes current EDIT STEP
EVC	Turns off all events
EVD	Sets all events to DONT CARE
EVF $n_{1\text{-}8}$, $x_{A\text{-}H}$	Sets selected events (1-8 and A-H) OFF (delimiters required between each selected event)
EVN $n_{1\text{-}8}$, $x_{A\text{-}H}$	Sets selected EVENTS (1-8 and A-H) ON (delimiters required between each selected event)
EVX $n_{1\text{-}8}$, $x_{A\text{-}H}$	Sets selected EVENTS (1-8 and A-H) to DONT CARE (delimiters required between each selected event)

FRS	Inserts the FIRST STEP of a new program with no parameters (uses the next available program and returns the program number selected)
FTH *n*	Sets FastTRAC HI TEMP Limit to *n*
FTL *n*	Sets FastTRAC LO TEMP Limit to *n*
GS n_1 n_2	Sets GUARANTEED SOAK Value for selected channel n_1 (1 or 2) to n_2
GTO *n*	Sets GOTO program number to *n*, returns goto step number
GTO n_1, n_2	Sets GOTO program number to n_1, step number to n_2, returns nothing
HL n_1 n_2	Sets selected channel n_1 (1 or 2) HI PROCESS LIMIT to n_2
INS	Inserts a new step into the current program with no parameters and increments subsequent existing step numbers
LL n_1 n_2	Sets selected channel n_1 (1 or 2) LO PROCESS LIMIT to n_2
LOP *n*	Sets number of cycles, returns step that the cycle begins on
LOP n_1, n_2	n_1 sets number of cycles, n_2 sets step cycle begins on
NXS	Moves to the NEXT STEP in the program
PBN *n*	Sets selected PROPORTIONAL BAND to *n*
PRL	Returns PROGRAMS currently in use
PRN	Returns current edit PROGRAM NUMBER
PRN *n*	Moves to selected PROGRAM number
PVS	Moves to the PREVIOUS STEP in the program
SSn_1 n_2	Sets selected channel n_1 (1 or 2) STEP SETPOINT to n_2
STM 0,0,0	Clears TIME
STM *n*	Sets HOURS to *n* (leading zeroes understood)
STM n_1, n_2	Sets HOURS to n_1 and MINUTES to n_2 (delimiter required between hours and minutes; leading zeroes understood)
STM n_1, n_2, n_3	Sets HOURS to n_1, MINUTES to n_2, and SECONDS to n_3 (delimiter required between hours and minutes; leading zeroes understood)
STN *n*	Moves to the specified STEP number *n*
TBD *n*	Sets ThermoBoost DECREASE Value to *n*
TBI *n*	Sets ThermoBoost INCREASE Value to *n*
TYP *x*	Sets STEP TYPE to : S - STANDARD (RAMP/SOAK); G - GOTO; E - END OF PROGRAM; L - LOOP; P - PAUSE

Revising PID Parameters

NOTES

1. To read the *current* value or setting for any parameter, omit any arguments (*n* or *x*) from the command.
2. You must select the PID channel, function and stage (with the command PID *nxx*) before you can read a value or setting.

DER *n*	Sets DERIVATIVE GAIN to *n*
ICP *n*	Sets INTEGRAL CLIP % to *n*
IDB *n*	Sets INTEGRAL DERIVATIVE BAND to *n*
INT *n*	Sets INTEGRAL TIME to *n*
PBN *n*	Sets PROPORTIONAL BAND to *n*
PGN *n*	Sets PROPORTIONAL GAIN to *n*
PID	Returns last accessed PID selection
PID *nxx*	Sets PID selection — 1,2 - channel 1 or 2; S,U - staged or unstaged; H,C - heat or cool Note that no delimiters are used between terms of the argument; also, the terms of the argument can be in any order. For example: 1SH — Channel 1, staged heat S2C — Channel 2, staged cool HU1 — Channel 1, unstaged heat
RWI *n*	Sets RESET WINDUP INHIBIT % to *n*

5.6 REMOTE INTERFACE VIA RS-232C SERIAL CONNECTION

1. Make RS-232C voltage connections from the remote computer to TB4 of the Model 620 Rear Interconnect Board (Figure 5-2) as shown in Table 5-3 below. Note that only three lines are required. Set programmer serial communication parameters as described in Para. 5.4.

TABLE 5-3. RS-232C VOLTAGE CONNECTIONS

Designation	TB4 Pin	Function
FR GND	1	Frame ground
/CTS IN	2	Receives clear-to-send signal from the computer
TXD OUT	3	Sends output from the Model 620 to the computer
/RTS OUT	4	Sends request-to-send signal to the computer
RXD IN	5	Receives input from the computer to the Model 620
GND	6	Ground
Pin Assignments for Conventional 25-pin RS- 232C Connectors (DB25)		
2 Transmit data	5	
3 Receive data	3	
7 Signal return	6	

When using a null modem cable, swap the wires going to TB4-3 and -5.

5.7 REMOTE COMPUTER INTERFACE VIA RS-422A/485 SERIAL NETWORK

A single master computer can communicate with up to 50 Model 620's on a party-line network. However, care must be taken to correctly connect the Model 620's and the master computer as described below.

5.7.1 Configuring the Model 620 for RS-422A/485 Communication

First, set Remote Computer mode and its parameters for RS-485 operation, including the programmer address, as described in Para. 5.4.

Unless your computer is equipped with an RS-422A port, you will need to install an RS-232C/RS-422A/485 level shifter (JC Systems Model 404 or equivalent) between the RS-232 serial port of the master computer and the first Model 620 in the network.

RS-422A/485 voltage-level connections from the computer to the first Model 620 on the party line are via RS-422A/485 Port P6, a DB37 37-pin connector, as shown in Figure 5-1. Connector J5 on the first Model 620 then connects to P6 on the second Model 620. Subsequent Model 620's in the network connect in the same manner as the first pair. (See Figure 5-3.)

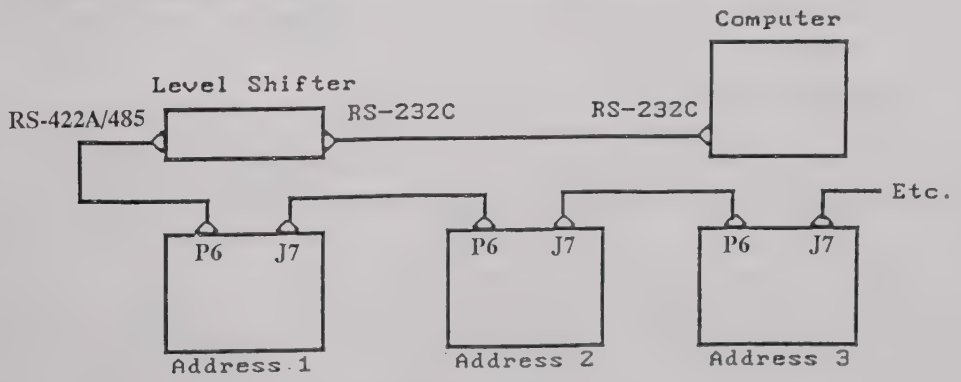


Figure 5-3. RS-422A/485 Party Line Communications.

TABLE 5-4: RS-422A/485 PORT PIN ASSIGNMENTS

FUNCTION	SIGNAL	COMPUTER VIA LVL SHFTR TO UNIT #1 P6 PIN NO.	UNIT #1 TO UNIT #2 J5 PIN NO.	UNIT #2 TO UNIT #3 P6 PIN NO.
Send Data (to Master	SD (A)	4	4	4
Computer)	SD (B)	22	22	22
Receive Data (from	RD (A')	6	6	6
Master Computer)	RD (B')	24	24	24
Signal Ground	SG	19	19	19
Shield 6	Shield	1	NC	1

NOTE

Shielded cable is required for the RS-422A/485 connection. Shield should be grounded at pin 1. Only connect one end of shield to ground.

5.7.2 Format for Entering RS-422A/485 Computer Commands

You must send the address of the specific Model 620 you want to query before you send the command code string. To enter the address, send a disconnect command — a number symbol (#) — followed by the address number assigned to the Model 620 (1-99). There must be a blank space between the disconnect command (#) and the address number as shown below.

Example: #_3

- Model 620 address number
- Blank space
- Number symbol (disconnect command)

The disconnect command disconnects all addresses, clearing the network. The Model 620 address number connects the computer to the selected address only,and the computer remains connected to that address until another disconnect command is received. Therefore, you only need to transmit the address once, immediately after the disconnect command. The computer will continue to address the same Model 620 from that time until the next disconnect command is sent.

5.8 REMOTE COMPUTER INTERFACE VIA IEEE-488 (GPIB) OPTION

This optional interface provides a remote IEEE-488 controller or computer with the same command and communications capabilities as the RS-232C interface described in Para. 5.4. In addition, the IEEE-488 option includes the capability to generate service requests upon deviation or setpoint alarm activity.

5.8.1 Configure Model 620 for IEEE-488 Interface

Set Remote Computer mode and its parameters for IEEE-488 operation, including the programmer address, as described in Para. 5.3. If the IEEE-488 computer interface option is installed, connect IEEE-488 system at the IEEE Connector on the Output Interface Board (Figure 5-1).

5.8.1.1 Read Service Request (Serial Poll) Data

When an alarm condition exists, the associated bits (0-3) will be set. Bit 6 will also be set, generating the SRQ. Two serial polls are then necessary to reset the serial poll.

- The first poll reads the status of the serial information.
- The second poll resets the bits if the condition no longer exists.

All Model 620's on the buss are polled by the computer to identify the one that generated the service request and to determine what condition(s) caused the service request to be generated.

The serial poll response from the Model 620's is an 8-bit word in ASCII characters that gives the computer this information. The list below explains the significance of each bit setting.

Bit 0 set — Channel 1 Deviation Alarm is ON
Bit 1 set — Channel 2 Deviation Alarm is ON
Bit 2 set — Channel 1 Setpoint Alarm is ON
Bit 3 set — Channel 2 Setpoint Alarm is ON
Bit 4 set — Not used
Bit 5 set — Not used
Bit 6 set — When any condition causes a Service Request
Bit 7 set — Not used

5.8.2 Remote Computer Operations via the IEEE-488 Interface.

5.8.2.1 Commands and Format

Commands and command format for the IEEE-488 interface are the same as those previously described for the RS-422A/485 interface (see Para. 5.5), except as follows:

1. The service request functions have been added as described below.
2. "#" (address) is not part of the transmitted command string as it is with the RS-422A/485.

5.8.2.2 Service Request Enable/Disable

To enable the service request function, an RQN command must be transmitted by the computer. An RQD command disables the service request.

RQN Service Request Enable

RQD Service Request Disable

NOTE

There is no memory of service request conditions that occur while the service request is disabled. Therefore, when the service request is enabled, a service request will not be generated for a condition that occurred while the service request was disabled.

6. Configuring the FastTRAC™ 620

6.1 ACCESSING CONFIGURATION SCREENS

1. From the Stop menu, press PAGE DOWN to access the Main Menu.

NOTE

During configuration, you can press RESET at any time to return to the Stop Menu.

2. Press 4 to access the Config-Tune-Calib menu.
3. If the screen prompts for the access code, enter the code. If you do not know the code, contact your supervisor. If the code has been forgotten, make a note of the numbers that appear in the last field of line 4 and call JC Systems Customer Service at 1- 800-444-9980. They can use those numbers to decrypt your access code.
4. If the Config-Tune-Calib menu appears, press 1 or 2 to select Programmer or Controller Configuration mode, respectively.
5. If the feature you want to configure is not on the first screen displayed, press PAGE DOWN to reach the desired configuration screen.

6.2 EXITING CONFIGURATION MODE

There are 9 separate screens in Programmer Configuration, and two in Controller Configuration. Depending on your position, you can repeatedly press either PAGE UP or PAGE DOWN to exit.

6.3 CONFIGURING THE MODEL 620 PROGRAMMER

6.3.1 Configuring for Local or Remote Operating Mode

1. When you select option 1 of the Configuration Menu, the display changes to the first programmer configuration screen. The cursor is in the Computer Interface Type field. Press SEL to toggle on the desired interface. The available interfaces are RS-232, RS-485, or IEEE-488. The IEEE-488 interface functions only if the IEEE-488 interface option is installed.

2. Use the arrow keys to move the cursor to the Current Operating Mode field on the third line of the display. Then press SEL to toggle from FRONT PANEL to EXT COMPUTER as desired.

NOTES

1. You must be in Front Panel mode (local operation) to configure the Model 620.

2. If you plan to monitor operations from a remote computer but have selected FRONT PANEL, you will still need to specify the interface type and communication parameters. Otherwise, proceed to the next screen or exit the Configuration Mode.

3. Move the cursor to the Baud Rate field (BAUD) on line 4 and press the SEL key to select the desired baud rate for serial communications. The SEL key provides for standard rates from 300 to 38,400 baud.
4. Move the cursor to the next (Parity) field and use the SEL key to select desired word length and parity for serial communications from the following: 7-bit even, odd, mark or space, and 8-bit no parity.
5. Move the cursor or press ENTER to store the last value.
6. Exit Configuration Mode or press PAGE DOWN to proceed to the next screen.

6.3.2 Select Operating Mode and FastTRAC™ Temperature Limits

1. Press SEL to toggle between standard TWO CHANNEL, FASTTRAC PASSTHRU, and FASTTRAC STANDARD. (See Chapter 1 for a description of FastTRAC™ operation.)
2. If you selected a FastTRAC™ mode, use the keypad to enter the desired values in the FastTRAC™ High and Low temperature limit fields on line 4 of the display. The range of available values is -99.9 to 537.7 °C (-147.8 to 999.9°F) for either field. This range of values permits bracketing the Channel 2 air temperature setpoint at absolute maximum and minimum values regardless of the Channel 1 setpoint and ThermoBoost™ settings.

NOTE

The FastTRAC™ temperature limits feature functions only in Standard FastTRAC™ mode. It is inactive in Passthru mode.

When either FastTRAC™ mode is selected, Channel 2 units automatically change to match the units selected for Channel 1. This change happens as soon as the FastTRAC™ display appears on the program mode screen. Once it is displayed, the Channel 2 units can be reset to the original setting only as described in Para. 6.4.1.

After selecting the FastTRAC™ temperature limits, Press PAGE DOWN to enter Channel 1 and 2 process limits.

3. Use the keypad to enter the desired values in the Channel 1 High and Low Process Limit fields on lines 3 and 4 of the display. The range of available values is -100 to 537.7 °C (-148 to 999.9°F) for either field. When the process variable exceeds either selected limit, an output for the appropriate channel is generated at TB1-9 or -10 of the Output Interface Board. The output resets when the out-of-limit condition is no longer present.
4. Press PAGE DOWN and repeat Step 3 for Channel 2.
5. Exit Configuration mode or press PAGE DOWN to proceed to the next screen.

6.3.3 Select Deviation Alarm Response

Use these screens (for Channels 1 and 2) to select how the Model 620 functions when an alarm condition exists.

6.3.3.1 Run or Stop During Deviation Alarms

With the cursor on the 2nd line of the display, press SEL to select PROGRAM STOPS or PROGRAM RUNS.

If you select PROGRAM RUNS, the Model 620 will continue running even though alarm limits have been exceeded.

If you select PROGRAM STOPS, the setpoint will latch at the temperature for the current step and the program will stop.

The alarm outputs will either latch (continue) or automatically reset (turn off), depending on your selection for alarm reset action below.

6.3.3.2 Reset Manually or Automatically

Move the cursor to the 4th line of the display and press SEL to select whether the alarm output resets MANUALLY or AUTOMATICALLY. If you select manual reset, whenever the alarm limits are exceeded:

- the Model 620 stops (the Time field value stops decrementing);
- the alarm limit energizes, and
- the applicable position in the ALM field flashes.

These conditions continue until parameters return within limits and RUN is restarted. If you select automatic reset, the Model 620 will automatically resume operation as soon as an out-of- limits condition ends. At the same time, the alarm outputs reset.

Press PAGE DOWN and set the alarm responses for Channel 2. Then exit Configuration mode or press PAGE DOWN to proceed to the next screen.

6.3.3.3 Select Programmer Synchro and Soft Start Status

1. Move the cursor to the appropriate field and press SEL to toggle between ENABLE and DISABLE. (See Para. 2.7 for a description of these features.)

NOTE

If the Model 620 does not have the synchronizer option installed, the synchronizer *must be disabled* for the programmer to run.

2. Exit Configuration mode or press PAGE DOWN to proceed to the next screen.

6.3.3.4 Adjust LCD Display and Select Programmer Time Base

1. Move the cursor to the Viewing Angle field and use the keypad to enter a number from 1 (display low relative to viewer) to 4 (display high).
2. Move the cursor to the Backlite Level field and use the keypad to enter a number from 1 (low intensity) to 4 (high intensity).
3. Move the cursor to the last line of the display and press SEL to select the programmer time base. The choices are the Model 620's INTERNAL CRYSTAL and 60HZ LINE or 50HZ LINE for use with the line frequency. The internal crystal is less subject to line fluctuations.

6.4 CONFIGURING THE MODEL 620 CONTROLLER

When you select option 2 of the Configuration Menu, the display changes to the Controller Configuration Menu. Press 1 to select Channel 1, or press 2 for Channel 2. For a discussion of menu option 3, Tune Controllers, refer to Appendix A.

The procedure for configuring both channels is the same except that the channel number you are configuring is displayed.

6.4.1 Select Units

The first line of the display shows the current units selected. Press SEL to select DEGREES C, DEGREES F, RH/WB (Relative Humidity Wet Bulb technique), or LINEAR (analog).

6.4.2 Specify Input Type

Move the cursor to the 2nd line of the display and press SEL to select the input type as follows.

TYPE T STD	TYPE T CRYO	TYPE J LO	TYPE J HI
RTD 100 EURO	RTD JIL	LINEAR	

6.4.3 Set Span (Setpoint Limits)

The setpoint limits determine the maximum and minimum setpoint values the controller channel will accept as valid. These limits also determine the 0-16mA or 4-20mA process or setpoint retransmit scale for the current output loop (next screen).

NOTE

Changing the controller span will affect the proportional band. Please be sure PID settings are correctly adjusted. Refer to Appendix A for instructions.

1. Move the cursor to the 4th line of the display and use the keypad to enter the setpoint minimum and maximum limits. Both can be in the range from -99.9 to 537.7°C (- 147.8 to 999.9°F).

2. Exit Configuration mode or press PAGE DOWN to proceed to the next screen.

6.4.4 Assign Current Loops

The FastTRAC™ 620 has two output current loops available. Each can be assigned to a separate channel, or both can be assigned to the same channel. In either case, the loops operate independently and so can be configured differently.

To assign a current loop, press SEL to toggle the current loop assignment between 1 and 2. Current Loop 1 is assigned from Channel 1, Current Loop 2 from Channel 2.

6.4.5 Select Current Output Range

Move the cursor to the third line of the display and press SEL to select either 4-20mA or 0-16mA output.

NOTE

Both current loops always must have the same range. If the range for either loop is changed, the range for the other loop changes to correspond.

6.4.6 Select Output Action

Move the cursor to the 4th line of the display and press SEL to select:

- REVERSE ACTING — heating action. The controller decreases the output as the process value approaches the setpoint from a temperature below the setpoint.
- DIRECT ACTING — cooling action. The controller decreases the output as the process value approaches the setpoint from a temperature above the setpoint.
- 12MA NULL — split-range operation. Current output is 12-20mA for 0-100% heat requirement and 12-4mA for 0-100% cooling requirement. The null output current value is 12mA. Table 6-1 shows how split-range operation affects current loop output.
- SETPOINT or PROCESS RETRANSMIT — retransmits an output current scaled to be equivalent to the setpoint or real-time process value.

When you have finished this screen, exit Configuration mode or press PAGE UP to return to an earlier controller configuration screen. (There is a third controller configuration screen, but it is reserved for future capabilities and is not yet active.)

TABLE 6-1: ERROR VALUE AND CORRESPONDING CURRENT OUTPUT FOR REVERSE ACTION

OUTPUTS IN SINGLE-CURRENT OPERATION(4-20MA)

ERROR (% BANDWIDTH)	OUTPUT CURRENT, mA	PERCENT POWER
+100.0	20.0	100 HEAT
+50.0	12.0	50 HEAT
0.0	4.0	0
-50.0	4.0	0 COOL
-100.0	4.0	0 COOL

OUTPUTS IN SPLIT-CURRENT OPERATION (12MA NULL)

ERROR (% BANDWIDTH)	OUTPUT CURRENT, mA	PERCENT POWER
+100.0	20.0	100 HEAT
+50.0	16.0	50 HEAT
0.0	12.0	0
-50.0	8.0	50 COOL
-100.0	4.0	100 COOL

6.5 Recording the Configuration

Table 6-2 on the following pages provides space to record the configuration settings you have selected.

TABLE 6-2. CONFIGURING THE MODEL 620 & 600

PROGRAMMER CONFIGURATION

CONFIGURE PROGRAMMER - PAGE 1:

Computer Interface *232 ___* *485 ___* *488 ___*

Address *NA* *____* *____*

Mode *Front Panel _____* *Ext Computer _____*

Baud Rate *_____* *_____* *NA*

Parity *8 bit None__ 7 bit even__ Odd__ Mark__ Spec _*

CONFIGURE PROGRAMMER - PAGE 2:

Two Ch. __ *Single Ch. __* *FastTRAC - Passthru __* *Std. __*

FastTRAC Temp Limits *LO: _____* *HI: _____*

CH1: LIMITS ASSIGNED TO - PAGE 3:

CH1 Process ____ *CH2 Process ____* *CH2 Setpoint ____*

Hi Limit _____ *Lo Limit _____*

CH2: LIMITS ASSIGNED TO - PAGE 4:

CH2 Process ____ *CH1 Process ____* *CH1 Setpoint ____*

Hi Limit _____ *Lo Limit _____*

CHANNEL 1 DURING DEV ALARM - PAGE 5:

Program: *Runs _____* *Stops ____*

Alarm Output Resets: *Manually ____* *Automatically ____*

CHANNEL 2 DURING DEV ALARM - PAGE 6:

Program: *Runs _____* *Stops _____*

Alarm Output Resets: *Manually ____* *Automatically ____*

SYNC. & SOFT START - PAGE 7:

Programmer Sync. *Enabled* ____ *Disabled* ____

Programmer Soft Start *Enabled* ____ *Disabled* ____

ON INPUT #8 - PAGE 8:

Do Nothing ___ *OR Run Program* ___ *PGM:* _____ *STEP* _____

OR Disable controller- _____

POWER FAIL RECOVERY - PAGE 9:

Normal Mode _____ *(Recover and Resume Operation)*

Hold Current Values *Ch1 Trip Dev:* ____ *Ch2 Trip Dev:* ____

*Run Prg:*___ *Stp:* ___ *Ch1 Trip Dev:* ____ *Ch2 Trip Dev:* ____

SITE ELEVATION FOR RH/WB COMPENSATION - PAGE 10

Site Elevation: _____ *Feet*

DISPLAY SETTINGS & TIME BASE - PAGE 11:

Viewing Angle *1* __ *2* __ *3* __ *4* __

Backlite Level *1* __ *2* __ *3* __ *4* __

Programmer Time Base *60 HZ* ___ *50 HZ* __ *Intl Crystal* ___

ACCESS CODE - PAGE 12:

Access Code *Yes* ___ *No* ____

If Yes: Code #: _____ *(4 Digits)*

CONTROLLER CONFIGURATION:

CONFIGURE CHANNEL 1 - PAGE 1:

Units: *Deg C ___* *Deg F ___* *RH/WB ___* *Linear ____*

RH_VISALA ____ *RH_HYCAL ____* *ALTUDE_FT ____*

Input: *T___* *J___* *K___* *R___* *S___* *E___* *B____*

RTD_____ *LINEAR_MV_____* *LINEAR_MA_____*

Setpoint Span Limits: *Max _____* *Min _____*

OUTPUT CURRENT LOOP 1 - PAGE 2:

Loop 1 Assigned to *Ch1 ____* *Ch2 ____*

MA Output *4 - 20 ____* *0 - 16 ____*

Output Action *Reverse____* *Direct ____* *12MA Null ____*

Setpoint Rexmit ____ *Process Rexmit ____*

Dual Acting _____

CHANNEL 1 COMPRESSOR TIME OUT / LOWPASS INPUT FILTER - PAGE 3:

Compressor timeout *CH1 =* *____:___* *(Min:Sec)*

Lowpass Input Filter CH1 = *____.___* *Seconds*

CHANNEL 1 AUTOMATIC GRADIENT OFFSET COMPENSATION - PAGE 4:

CH1	*CONTROLR*	*CHAMBER*
LOW:	_____.__	_____.__
MED:	_____.__	_____.__
HIGH:	_____.__	_____.__

NOTE: *"DO NOT" ATTEMPT TO CALIBRATE THE CHANNEL 1 CONTROLLER UNLESS THE TWO VALUES FOR THE CONTROLR & CHAMBER ARE IDENTICAL FOR THE LOW, MED AND HIGH SETTINGS. TO CALIBRATE THE CONTROLLER SET IN EQUAL CONTROL & CHAMBER VALUES, CALIBRATE THE CONTROLLER, THEN REENTER THE OFFSET VALUES PREVIOUSLY BEING USED.*

CONTROLLER CONFIGURATION:

CONFIGURE CHANNEL 2 - PAGE 1:

Units: *Deg C ___* *Deg F ___* *RH/WB ___* *Linear ____*

RH_VISALA ____ *RH_HYCAL ____* *ALTUDE_FT ____*

Input: *T___* *J___* *K___* *R___* *S___* *E___* *B_____*

RTD_____ *LINEAR_MV_____* *LINEAR_MA_____*

Setpoint Span Limits: *Max _____* *Min _____*

OUTPUT CURRENT LOOP 2 - PAGE 2:

Loop 2 Assigned to *Ch1 ____* *Ch2 ____*

MA Output *4 - 20 ____* *0 - 16 ____*

Output Action *Reverse____* *Direct ____* *12MA Null ____*

Setpoint Rexmit ____ *Process Rexmit ____*

Dual Acting _____

CHANNEL 2 COMPRESSOR TIME OUT / LOWPASS INPUT FILTER - PAGE 3:

Compressor timeout *CH2 =* *____:___* *(Min:Sec)*

Lowpass Input Filter CH2 = *____.___* *Seconds*

CHANNEL 2 AUTOMATIC GRADIENT OFFSET COMPENSATION - PAGE 4:

CH2	*CONTROLR*	*CHAMBER*
LOW:	_____.___	_____.___
MED:	_____.___	_____.___
HIGH:	_____.___	_____.___

NOTE: *"DO NOT" ATTEMPT TO CALIBRATE THE CHANNEL 2 CONTROLLER UNLESS THE TWO VALUES FOR THE CONTROLR & CHAMBER ARE IDENTICAL FOR THE LOW, MED AND HIGH SETTINGS. TO CALIBRATE THE CONTROLLER SET IN EQUAL CONTROL & CHAMBER VALUES, CALIBRATE THE CONTROLLER, THEN REENTER THE OFFSET VALUES PREVIOUSLY BEING USED.*

7. Maintenance and Calibration

7.1 PREVENTIVE MAINTENANCE

7.1.1 Cleaning

Regularly dust outside surfaces and keep the Model 620's interior free of dust and debris, especially pieces of wire that could cause shorts.

7.1.2 Other Preventive Maintenance

1. Perform the calibration procedures described in this chapter at least once a year.
2. Replace the lithium battery every five years.

7.2 CALIBRATE CONTROLLER

The controller is calibrated before shipping from JC Systems. Calibration parameters used by JC Systems are shown on the Calibration Parameters Sheet included as the first page of this manual. Perform any subsequent calibration as specified below, using the values provided on the Calibration Parameters Sheet.

7.2.1 Equipment Required

1. Thermocouple calibration standard (calibrator) such as Wahl Instruments Model C-65 or Biddle Model 720350.
2. Thermocouple extension wire of the required type for the unit being calibrated.
3. Temperature sensor to measure ambient temperature.
4. Millivolt or milliamp current source for linear input calibration.
5. Precision resistance box, accuracy 0.1% or greater, or RTD calibrator.

7.2.2 Accessing Calibration Screens

1. From the Stop menu, press PAGE DOWN to access the Main Menu.

NOTE

During calibration, you can press RESET at any time to return to the STOP screen.

2. Press 4 to access the Config-Tune-Calib menu.
3. If the screen prompts for the access code, enter the code. If you do not know the code, contact your supervisor. If the code has been forgotten, make a note of the numbers that appear in the last field of line 4 and call JC Systems Customer Service at 1-800-444-9980. They can use those numbers to decrypt your access code.
4. If the Config-Tune-Calib menu appears, press 3 or 4 to select Inputs or Outputs Calibration, respectively.
5. If the feature you want to calibrate is not on the first screen displayed, press PAGE DOWN to reach the desired calibration screen.

7.3 EXITING CALIBRATION MODE

There are seven separate screens in Calibrate Inputs and four in Calibrate Outputs. Depending on your position, you can repeatedly press either PAGE UP or PAGE DOWN to exit.

7.4 CALIBRATING INPUTS

When you select option 3 of the Calibration menu, the display changes to show the current configuration and prompts you to press PAGE DOWN to calibrate Channel 1. The procedure for calibrating both channels is the same except that the channel number you are calibrating is displayed.

NOTE

In Calibration mode, the ENTER button *must* be used to input calibration values. Pressing PAGE UP or PAGE DOWN will display the last calibration value, but will not enter any new values.

7.4.1 Cold Junction Calibration

NOTE

Both channels use the same cold junction, so this calibration only needs to be performed once. Press PAGE DOWN the second time the cold junction calibration screen appears.

1. The siliconed-sealed cold junction is located next to TB1 on the Rear Interconnect Board. Measure the cold junction temperature and use the keypad to enter this value in the CJ TEMP = field. The unit will accept values from -9.9 to 99.9°F (-23.3 to 37.7°C).
2. Push ENTER and wait a few seconds, then press PAGE DOWN. (PAGE DOWN will not function until calibration is complete.)

7.4.2 Connect Calibrator

1. Disconnect thermocouples.
2. Using the thermocouple extension wire, connect the calibrator to the temperature controller input: Channel 1, TB1-2 (+) and -3 (-); Channel 2, TB1-4 (-) and -5 (+).

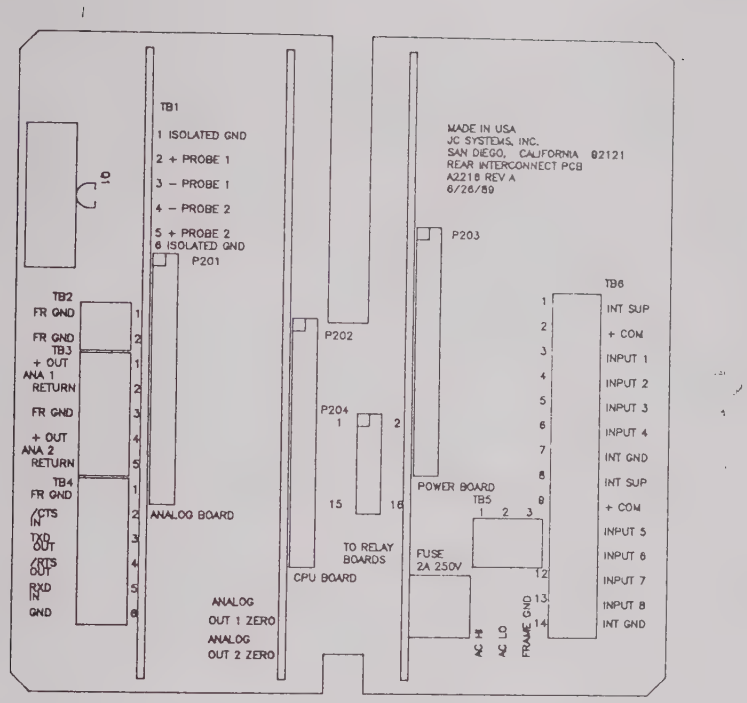


Figure 7-1. Rear Interconnect Board.

7.4.3 Thermocouple Input Calibration

7.4.3.1 Channel 1 Low Calibration

After performing cold junction calibration, pressing PAGE DOWN brings you to the LO calibration screen. Proceed as follows:

1. If not already present, connect calibrator per 7.4.2 and set for output mode.
2. Set calibrator to ambient temperature (approximately 25°C or 77°F).
3. Use the keypad to enter the value of the calibrator setting.
4. Press ENTER to record the value, then press PAGE DOWN.

7.4.3.2 Channel 1 High Calibration

After performing low calibration, pressing PAGE DOWN brings you to the HI calibration screen.

1. Adjust calibrator output to approximately 200°C (392°F).
2. Repeat Para. 7.4.3.1, Steps 3&4.

7.4.3.3 Channel 2 Calibration

After completing Channel 1 high calibration, pressing PAGE DOWN brings you to the Channel 2 information screen. If the cold junction has been calibrated already (per Para. 7.4.1), press PAGE DOWN twice to move to Channel 2 low calibration. Then repeat Para. 7.4.3.1 & 2 to calibrate Channel 2.

Repeat Para. 7.4.3.1&2 to calibrate Channel 2.

7.4.4 RTD Input Calibration

1. RTD's do not require cold junction calibration. Press PAGE DOWN to move to low and high calibration screens.
2. Connect a precision resistance decade box of 0.1% accuracy or better, or an RTD calibrator, across the temperature input terminals (see Para. 2.5.2).
3. Calibrate low and high values for both channels as described in Para. 7.4.3 for thermocouples, substituting the following values:
   - Low calibration — 0.0°C (100.00 Ω)
   - High calibration — 195.0°C (174.00 Ω)

7.4.5 Linear Input Calibration

1. Using standard copper wire, connect the appropriate current source (milliamp or millivolt, depending on linear input type) to the inputs for the channel to be calibration. For this example, only Channel 2 will be calibrated with a 4-20 mA current source representing 0-100% relative humidity.
2. Set current source to 4.00 mA. Using the numeric keypad, enter 0.0, press ENTER, and press PAGE DOWN.
3. Set current source to 20.00 mA. Using the keypad, enter 100.0, press ENTER, and press PAGE DOWN.
4. Repeat Steps 2 and 3 for Channel 2.

7.5 Output (Current Loop) Calibration

Access the output calibration screen as described in 7.2.2: from the Config-Tune-Calib menu, press 4. The Loop 1 00.00 mA output calibration screen will appear.

NOTE

The current loop outputs are always calibrated at 0 and 16 mA, even if they are used at 4-20 mA.

1. Connect the voltmeter to Rear Interconnect Board TB3 pins 1 (positive) and 2 (negative) (see Figure 7-1).
2. When the output calibration screen appears, the Loop 1 output is forced to 0.000 mA.Follow the display prompt: adjust OUT 1 ZERO (at bottom of Rear Interconnect Board) until the meter reads 00.001mA, then press PAGE DOWN. The Loop 1 16.00 mA output calibration screen will appear.
3. When this screen appears, the Loop 1 output is forced to 16.00 mA. With the meter still connected as in Step 1, use the keypad to enter the meter reading on line 4 and press ENTER. The displayed meter reading will change to 16.000 when calibration is complete.
4. Press PAGE DOWN and repeat Steps 1 through 3 for Current Loop 2, substituting TB3-4 (positive), TB3-5 (negative), and OUT 2 ZERO.

APPENDIX A (NOTE: SEE FOLLOWING SECTION FOR THEORY)

MODEL 620 & 600 PID INFORMATION AND ADJUSTMENTS

DUAL PID PARAMETERS

Each control channel has two sets of dual pid parameters. A dual pid parameter set is another way of stating that the heating (increase action) control and the cooling (decrease action) control can have different PID value settings. The two sets of dual pid settings are referred to as **p_set1** and **p_set2.**

P_set2 parameters can be utilized by turning on the appropriate event (Event G for Ch1, H for Ch2) when the **p_set2** capability is enabled. This "enable" selection is accessed at the end of the pid adjustments for each channel .

The **PID** adjustment selection screen is accessed by pressing the following keys (from the "home stopped" screen):

PageDown -> MAIN MENU
4 -> CONFIG-TUNE-CALIB
2 -> CONFIG.CNTRLS/TUNE
3 -> TUNE CONTROLLERS
abbreviated as **PageDown,4,2,3.**

The selection screen resulting from the above key strokes is the access screen for adjusting the different **p_sets**.

You are provided with four selections (1 to 4) which are:

1=CHANNEL1 P_SET1
2=CHANNEL1 P_SET2
3=CHANNEL2 P_SET1
4=CHANNEL2 P_SET2

You will typically be using selections 1 and 3 because **p_set1** is the default. **P_set2** pid sets must be enabled and their respective selection event turned **ON** to be active.

After you select **ch1** or **ch2** to tune, the pid access screens will show both the **INC (heating)** and **DEC (cooling)** values for each of the pid settings. Everything in the first column under **INC** are the heating pid values. The cooling pid values are shown in the second column (**DEC**).

To change a value, move the cursor over the value to be changed, enter the new value and either push <**ENTER**> or move the cursor to a different location.

CYCLE TIME AND TIME PROPORTIONING OUTPUTS

A time proportioning control output is either full **ON** or full **OFF**. Proportioning action is obtained by changing the **ON time** (consequently the **OFF time**) for consecutive equal time periods. This time period is called the **Cycle Time**. The unit of Cycle time is seconds.

For example, a controller with a four (4) second cycle time would turn the heaters **ON** for 2 seconds and **OFF** for 2 seconds during every consecutive four second time period to provide 50% heat output .

PBAND (PROPORTIONAL BAND)

The proportional band (in degrees) is equal to the smallest error (setpoint temperature - actual temperature) in degrees that is required to produce a 100% output .

Changing the proportional band **(PBand)** automatically changes the Proportional Gain **(PGain)**. You will be working with the PBand for all

applications other than the FastTrac Configuration and Channel 1.

PGAIN (PROPORTIONAL GAIN)

Proportional gain is the ratio of the **setpoint span** to the **proportional band**

PG = Setpoint Span/PBand

You will only be concerned with proportional gain when you are in FastTrac mode and channel 1.

RESET (INTEGRAL ACTION)

The reset action is a correction factor developed due to a difference between the **Setpoint** and the **actual Chamber Temperature** existing for a period of time. This error (**Setpoint - Chamber Temperature**) is called the **deviation .**

This automatic reset correction is added or subtracted (internally) by the microcomputer to force the actual temperature to the value of the Setpoint.

Typical values other than Ch1 FastTrac Mode, are 0.16 to 0.8 repeats per minute of reset action. A good setting to try is 0.32.

If you are in FastTrac Mode, the Reset setting for Channel 1 is typically somewhere between 0.5 and 2.0 with 1.0 being a good value to try first.

RWI_% (RESET WINDUP INHIBIT)

The **RWI** puts a cap on the maximum error that is Integrated (Reset Action). This minimum error value is the product of the **RWI** setting in % times the **PBand** and is displayed as **RWI_UNITS**. Any error greater

than the **RWI_UNIT** value is treated like it was equal to the **RWI_UNIT** value.

Typically, a **RWI** setting that result of 2.0 to 4.0 degrees works out well.

This feature keeps the reset action from over correcting when a step change of Setpoint occurs.

RESET_CLIP%

Reset_Clip operates on the stored Integral (reset) correction when setpoint ramps are used. The stored integral correction is reduced by a percentage equal to the value of the **Reset_clip** setting when the system overshoots.

This overshoot occurs because the **chamber temperature** is usually within the **PBand** and integral (reset) action takes place during the temperature ramp,.

The integral action (reset action) produces enough "overdrive" on the control action to make the chamber temperature catch up to the setpoint during a ramp. Everything is fine until the ramp is finished. Now, there is too much stored integral correction, since the Setpoint is not changing anymore. This causes the system temperature to overshoot the setpoint temperature.

Anytime the chamber temperature is overshooting the setpoint by an amount greater than the **value of the ID_BAND setting** and the **overshoot is increasing,** the **stored Integral (Reset) correction** is reduced by an amount equal to the **Reset_Clip** setting.

The **INC ID_Band** is used for heating and the **DEC ID_Band** is used for cooling.

This check and correction occurs once for each time proportioning period (Cycle Time).

It might be said that the excessive stored integral is "clipped" by the Reset_Clip action of the controller.

If you make use of the Reset_Clip capability, be careful about using too high a value. Typical values range between 3% and 7%

RATE (DERIVATIVE ACTION)

Rate action can be thought of as Dynamic Damping on changes of chamber temperature. The faster the temperature is changing, the greater the rate action. Rate action reduces or increases the control output to oppose the change in temperature.

If you have a fast change rate chamber, do not use any rate action.

Values of rate for systems that have a large thermal lag time, typically range from 0.1 to 0.4.

Be careful about using Rate action as a little goes a long way. Too much rate action slows down a chamber excessively.

ID_BAND (JCS answer to Dead Band)

When a controller has a "dead band" (also referred to as control crossover band) there is a range of temperatures around the setpoint in which there is no control action output. This takes care of the problem of

the control cycling between heat and cool but the system can drift within this "dead band".

The ID_BAND is a range of temperature errors around the setpoint in which all of the control actions are not really dead. The Reset (Integral Action) and Rate (Derivative Action) are fully functional while the deviation error is equal to or less than the ID_BAND adjustment. Only the Proportional Action is "dead" within the ID_BAND. If an error exists, the Integral Action (Reset) will add correction and the error will be forced to zero (even though it is within the ID_BAND).

Dead Band = No Control Action
ID_Band = Integral Action (Reset) and Derivative action (Rate)

MIN_OUTPUT (units are %)

The value for this parameter is normally set to 0%. This display is the power left ON when the controller is calling for 0 output.

The ability to leave on some power even though the controller is calling for the opposite output mode is useful in certain applications.

One application is that of a steam generator (or boiler) in a Temperature/Humidity Chamber. Allowing the water to cool when the chamber is dehumidifying can result in a very long time lag before humidity can be added if the chamber is programmed to a higher Humidity. This delay (due to heating all of the water) can be greatly minimized by leaving 5 or 10% heat input going into the boiler.

NOTE: The MIN_OUTPUT% must be zero (0) if a JCS 2192 Chamber Enhancer Module is being used.

MAX_OUTPUT (units are %)

This entry Caps the maximum power that can be delivered from the controller. One place that this is utilized is in kiln applications where full continuous power could damage the heaters at low temperatures.

TYPICAL PID SETTINGS

The actual values for the pid settings for your chamber can vary depending on the characteristics of the chamber.

Some good starting values are listed below for various types of chambers:

NON STAGED CHAMBERS

A non staged chamber is one that has only one set of heaters or one coolant valve.

Note:

A chamber that incorporates a 4 - 20 ma. SCR controller to proportion power to the heaters is not considered a "Non Staged chamber".

Suggested tuning information is provided on the following tables. Determine what type of chamber your are working with and refer to the appropriate table. The information in the tables are starting values as each chamber is different.

Once you have adjusted the pid values for your chamber, write them down or save them to disc with the utility programs available from JC Systems. If you move controllers around, simply put in the parameters for the particular chamber and you are ready to run.

Heating, Humidify, (INC)

Suggested settings to try as a starting point

	Non Staged chamber	Staged with 2192 split band	Staged with 2192 Time Delay	Staged with Electro-Mech T.D. relays	4 - 20 ma. SCR Pwr Controller	Humidity (non - staged)
CYCLE TM	4	4	4	4	2	4
PBand	6.0 C	9.0 C	10.0 C	10.0 C	8.0 C	20 % RH
RESET	0.32	0.32	0.32	0.32	0.32	0.20
RWI_%	50	33	40	40	25	10
RWI_UNIT	3	3	4	4	2	2
RST CLP%	0	0	0	0	0	0
RATE	0	0	0	0	0	0.1
ID-BAND	0.5	0.5	0.5	0.5	0.5	0.5
Min_Outpt	0 %	Always 0%	Always 0%	0 %	0 %	0 %
Max_Outpt	100 %	100 %	100 %	100 %	100 %	100 %

for Cooling, De-Humidify, (DEC) or FastTrac Settings, see other pages

Cooling, Dehumidify, (DEC)

Suggested settings to try as a starting point

	Non Staged chamber	Staged with 2192 split band	Staged with 2192 Time Delay	Staged with Electro-Mech T.D. relays	Fast D/A 4 - 20 ma. Coolant Valve	De - Humidify (non - staged)
CYCLE TM	4	4	4	4	2	4
PBand	6	9	10	10	8	20
RESET	0.32	0.32	0.32	0.32	0.32	0.20
RWI_%	50	33	40	40	25	10
RWI_UNIT	3	3	4	4	2	2
RST CLP%	0	0	0	0	0	0
RATE	0	0	0	0	0	0.1
ID-BAND	0.5	0.5	0.5	0.5	0.5	0.5
Min_Outpt	0 %	**Always 0%**	**Always 0%**	0 %	0 %	0 %
Max_Outpt	100 %	100 %	100 %	100 %	100 %	100 %

for Heating, Humidity, (INC) or FastTrac Settings, see other pages

SETTINGS CHANNEL 1 IN FastTrac Mode

	Part Sensor (Ch1) in air only	Part Sensor (Ch1 on PC board in Air Flow	Part Sensor (Ch1) on Heat Sink or Metal Case of Module
Cycle time (seconds)	2	2	2
PGain	0.5	1.5	4
Reset	1.0	1.0	1.0
RWI_%	100 %	100 %	100 %
RWI_%, RATE, ID_Band	0	0	0
Min_Output %	0 %	0 %	0 %
Max_Output %	100 %	100 %	100 %

NOTE: REMEMBER TO ASSIGN CURRENT LOOP 1 TO CHANNEL 2

CHANNEL 2 for FastTrac Fast Chamber

(HI HEAT & Proportional valve 4-20 LN2 C00LING)

	INC (HEATING)	DEC (COOLING)
CYCLE TIME	2 SEC	2 SEC
BAND	25 DEGREES C	30 DEGREES C
RESET	0.2	0.2
RWI_%	100%	100%
RWI_UNITS	25	30
RESET_CLIP%	0	0
RATE	0	0
ID_BAND	2	2
MIN_OUTPUT	Always 0 %	Always 0 %
MAX-OUTPUT	100 %	100%

NOTE: REMEMBER TO ASSIGN CURRENT LOOP 1 TO CHANNEL 2

A. PID Parameters and Their Adjustment

A.1 INTRODUCTION

All JC Systems controllers are three-mode controllers offering proportional, integral and differential control actions. These three control actions are independently derived, then summed to act upon the controller output. The following information provides a basic description of the three control actions and how they interact, followed by specific instructions for using Model 620 FastTRAC™ tuning capabilities to adjust PID parameters.

A.2 DEFINITIONS

The following definitions will be more fully explained in the accompanying text.

Some of these terms are also illustrated in Figure A-1.

Process Variable — The variable (temperature, humidity, pressure), being directly controlled; its value is sensed to originate the feedback signal.

Process Value — the instantaneous (real-time) measured value of the process variable.

Setpoint — An inputted variable that specifies the desired value of the controlled variable.

Deviation — The difference between the setpoint and the process value, also referred to as "error" or "droop".

Internal Setpoint — A setpoint derived by a controller using reset action. The internal setpoint is the controller's automatic internal equivalent to a manual setpoint.

Proportional Bandwidth — The bandwidth from zero deviation to the deviation from setpoint (in degrees) that will produce 100% output. Bandwidth is determined by the ratio of the span (in degrees) to the selected proportional gain.

Span — The range of possible setpoints for the controller: the algebraic difference between the lowest and highest possible setpoints. For example, if the lowest setpoint value is -100.0 and the highest is +315, the span is 415.0 [+315 - (-100) = +415].

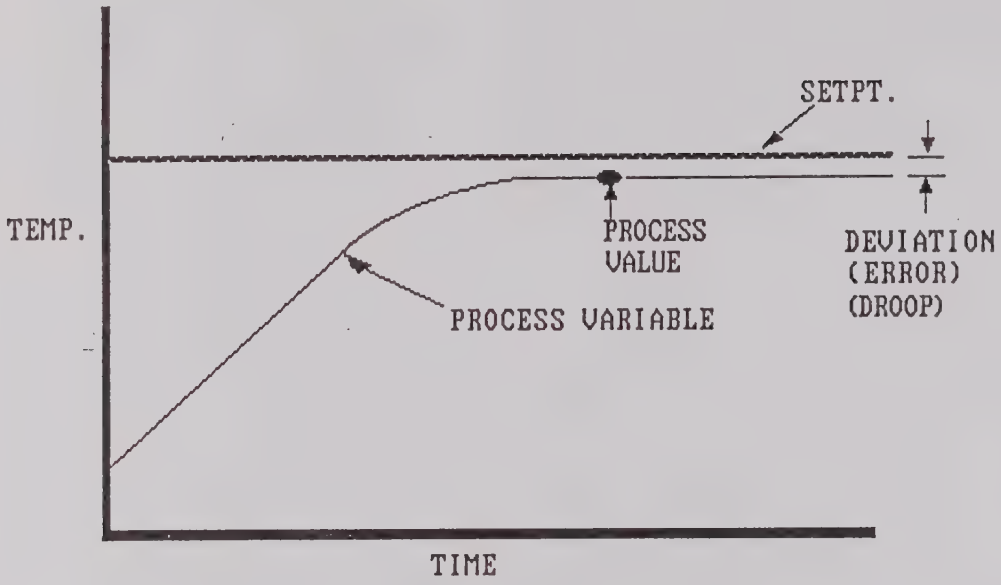


Figure A-1. Terms Used in Profile Charts.

A.3 DESCRIPTION OF CONTROL ELEMENTS

A.3.1 Proportional Control

A.3.1.1 Theory of Operation

The first element, or control action, of a PID controller is P - the proportional factor. The action of the controller is proportional if the controller produces an output that is proportional to the deviation (setpoint - process value). In other words, the controller output (in percent) changes linearly as a function of the deviation.

As shown in Figure A-2, the digital process value PV is received from the monitoring equipment (thermometer in this case) and compared with the digital setpoint SP. The difference is the deviation DEV, which is the error between the desired setpoint and the actual process value. Because no other control actions are in effect, this deviation is used to calculate output power.

The proportional bandwidth is expressed in degrees. Zero degrees (0°) corresponds to no deviation from setpoint and therefore no output. The total bandwidth in degrees corresponds to the deviation from setpoint that will produce 100% output. For example, a proportional bandwidth of 6° will result in 50% output when the deviation is 3° and 100% output when the deviation is 6°. As shown in Figures A-2 and A-3, a temperature chamber controller operating with proportional action only and a proportional bandwidth of 6° will apply 50% power to the heaters if the setpoint is 300° and the system temperature is 297° (deviation = 3°).

The proportional output value will always be a percentage of the total possible output. This is true whether using 4-20 mA power proportioning output or ON-OFF time proportioning output. For example, power proportioning output for a +50% error would be 12 mA in a 4-20 mA application. In time proportioning output for the same error, output would be ON 50% of the cycle time and OFF 50% of the cycle time.

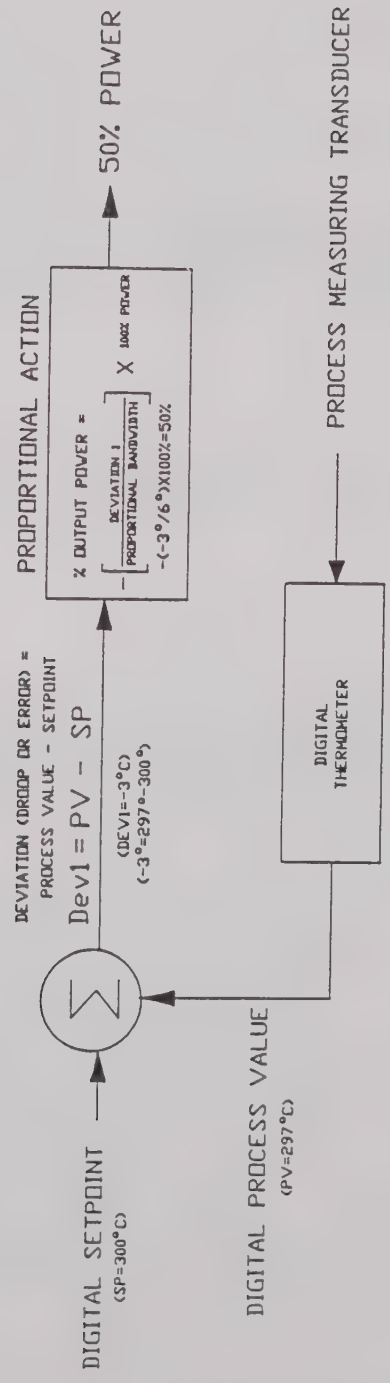


Figure A-2. Proportional Control Action Diagram.

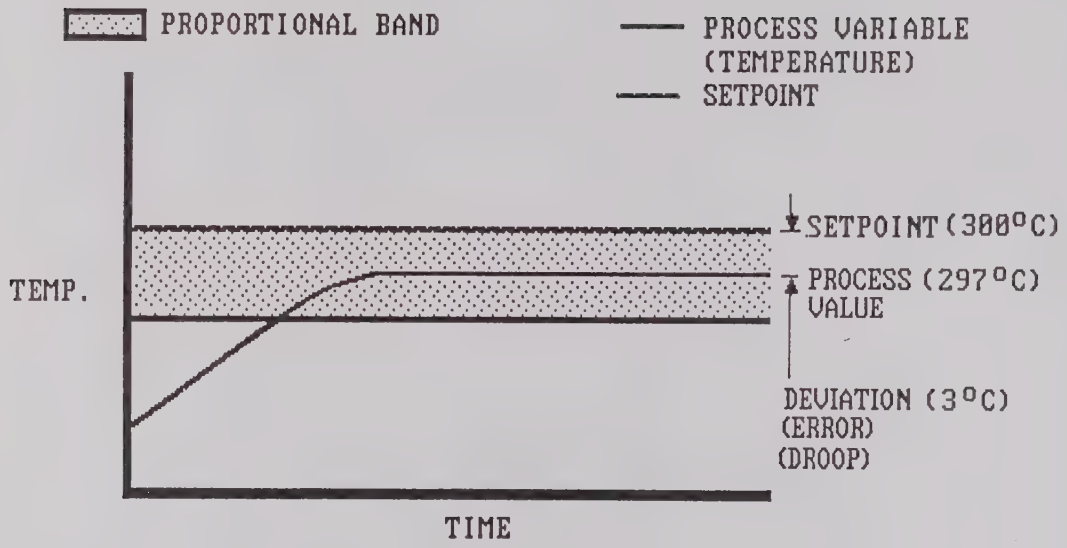


Figure A-3. Proportional Control Profile Chart.

Note that JC System controllers provide dual outputs to control both heating and cooling, so the proportional band would extend both above and below the chosen setpoint. For clarity, the cooling band has been omitted from the figures.

A.3.1.2 Droop

A condition known as droop (see Figure A-4) always occurs in a system that has a controller with only proportional action. This is because there must be some offset from the setpoint before proportional action can apply power to make up for system heat loss. In this sense, "droop" is a specific type of deviation or error, but the word is also sometimes used to refer to any error condition.

For example, suppose our temperature chamber has a maximum heater capacity of 1500 watts and its thermal characteristics require a power input of 750 watts to maintain 297°C with a constant ambient temperature of 25°C. With a typical proportional bandwidth of 6° and a setpoint of 300°, the system temperature would stabilize at 297°. Why? Because the 3° deviation from setpoint requires 50% proportional output, which is the same amount of power we already established as being required to maintain the system at 297°.

The two methods used to counteract this condition, manual and automatic reset, are described below.

A.3.1.3 Manual Reset

Given the error described in A.3.1.2, you could manually reset the setpoint to 303°C. The higher temperature setting would demand the extra power required to increase the process value by 3° .

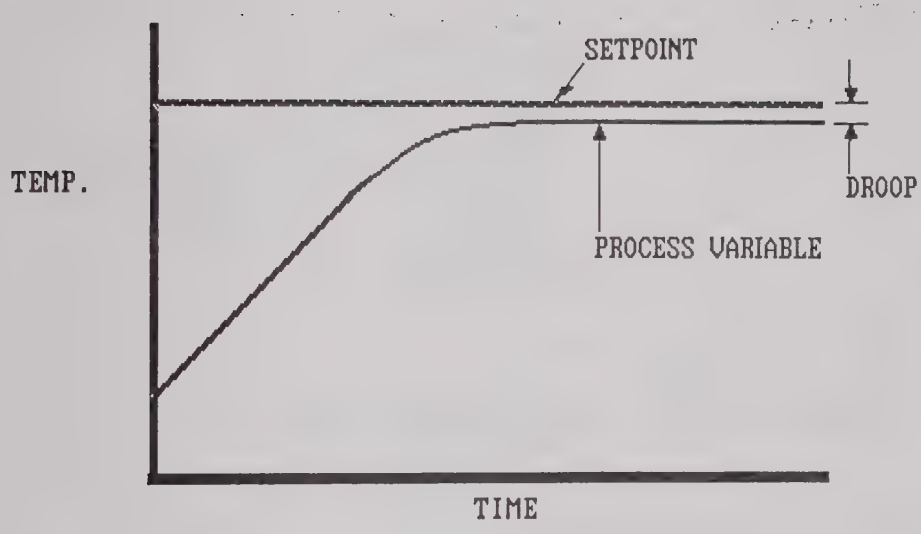


Figure A-4. Droop.

Many simple controllers with proportional action incorporate provisions for manually compensating the offset (in this case three degrees) for a fixed temperature. Obviously, this approach is inefficient when changes in the setpoint are desired. Also, any given offset can only work for a particular setpoint and constant heat load with no changes in ambient temperature. A more effective system utilizes integral control action as described in the following section.

A.3.2 Automatic Reset (Integral Control)

A.3.2.1 Theory of Operation

The second control action of a PID controller is I - the integral factor, also commonly referred to as reset. This control action generates a correction factor by integrating (as a function of time) the deviation (error) between the setpoint and the process value. Integral action automatically and internally performs the same function as the manual reset. The setpoint is internally corrected (reset) to a value that will completely offset the deviation as shown in Figure A-5.

In other words, the integral action I correction factor is exactly the opposite of the deviation (error or droop). As shown in Figure A-6, this correction factor is added to the original setpoint to create a new, internal setpoint. The internal setpoint in turn is used to calculate an adjusted error derived by summing the correction factor and the setpoint, minus the process value. This adjusted error is used to calculated the output power that must be supplied to the system.

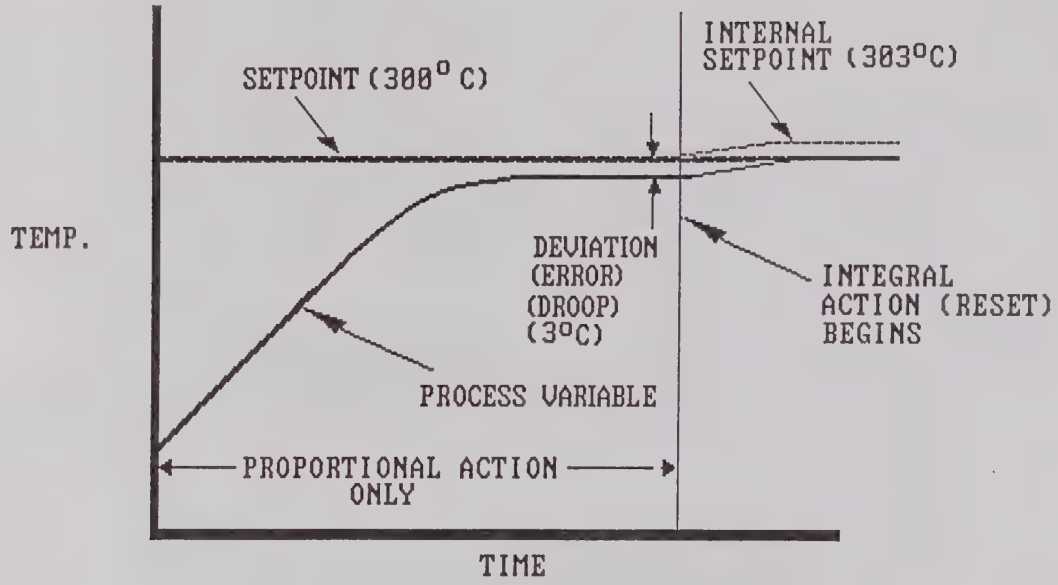


Figure A-5. Reset Used to Correct Droop.

For example, as previously shown (in Figure A-4) a setpoint of 300° and a process value of 297° results in a droop (error or deviation) of -3°. The correction factor (value required to offset the droop) is therefore +3°. As shown in Figure A-6, the new internal setpoint is therefore the setpoint (300°) plus the correction factor (3°), and the adjusted error is 300° minus 303° (the process value), or -3°. With a proportional bandwidth of 6°, this will result in 50% output power (3° ÷ 6° = 0.5 x 100% = 50%).

Automatic reset action repeats the correction factor X times per minute, causing a recalculation of the internal setpoint for each repeat. The value selected determines how fast the controller corrects for the deviation in terms of repeats per minute.

For example, if reset were set for one repeat per minute and the error remained constant, the correction factor would be repeated once per minute, causing the internal setpoint to linearly ramp up. In other words, with a theoretical constant error of 3°, the internal setpoint would increase 15° in 5 minutes (5 minutes times 1 reset/minute = 5, or 5 resets times 3° = 15°).

Of course, the error would not remain constant in an actual process, so this effect could not normally occur.

A.3.2.2 Reset Windup

Reset windup is a problem that can result with most other PI controllers that don't offer features included in the JC Systems controllers. Most controllers with integral action will make a correction proportional to the magnitude of the deviation whenever a deviation exists. As shown in Figure A-7, when a process starts with an extremely large deviation, this large error will be integrated and the setpoint will be internally corrected on this basis. Reset action will continue as long as the error exists. This effectively "winds up" the internal setpoint.

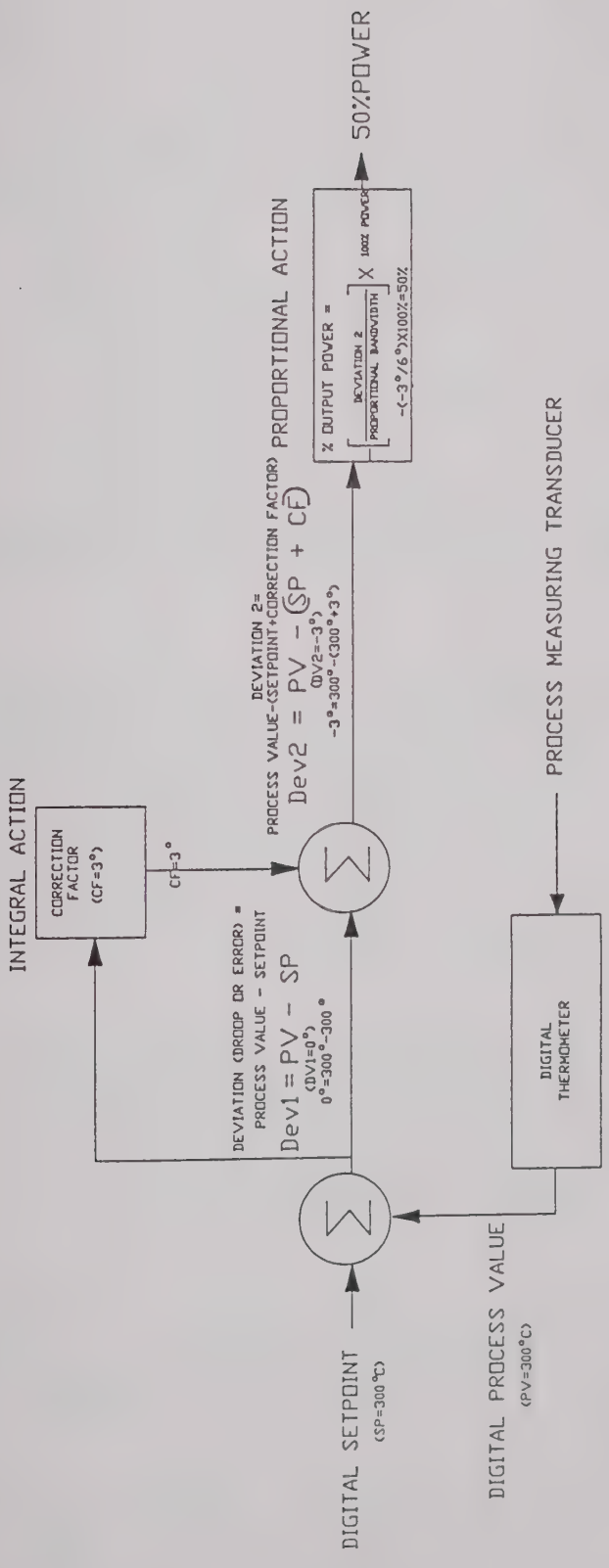


Figure A-6. Proportional Control with Integral Action.

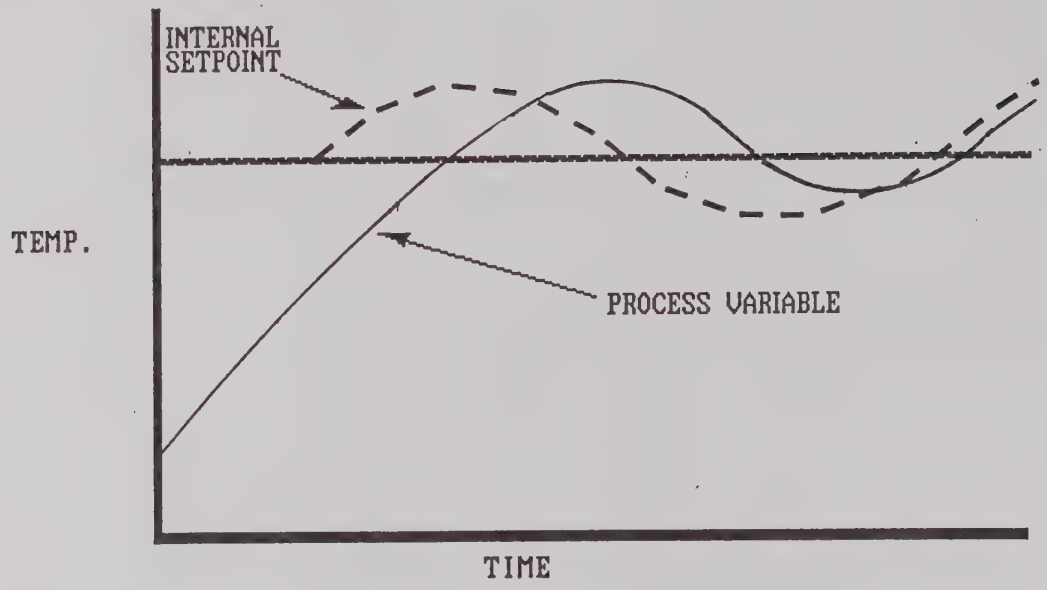


Figure A-7. Oscillations Due to Reset Windup.

By the time the process value finally reaches the original setpoint, the internally reset setpoint is much higher and a deviation still exists. The controller's proportional action (P factor) uses this deviation to regulate output, thereby causing an overshoot. As the process value approaches the internal setpoint, the controller detects that a negative deviation now exists between the internal setpoint and the original one. Integrating this error drives the internal setpoint, and therefore the process value, back down. Rather than providing a realistic reset factor, the integral action is now driving the process value up and down around the setpoint. This oscillation will continue for some time (depending on system response, integration value, and other factors) until the system finally stabilizes.

A.3.2.3 Reset Windup Inhibit

JC Systems controllers counteract reset windup in two ways. First, integral action does not correct for a deviation unless the process value is within the proportional bandwidth. In other words, with a bandwidth of 6°, integration would occur only with a deviation of 6° or less.

Second, your JCS controller has a separate selectable parameter called Reset Windup Inhibit (RWI). This allows you to specify (as a percentage of the proportional bandwidth) the maximum error in degrees that the controller will integrate as a function of time to adjust the internal setpoint.

For example, with a bandwidth of 10° and an RWI setting of 10%, a deviation of any magnitude between 1 and 10 ° will be treated as a deviation of only 1° (10% of the 10° proportional bandwidth). Only when the actual error is less than 1° will the actual error be integrated. This allows much higher integration values without causing over-integration instability (oscillation).

Another feature of JC Systems' Model 620 is reset clip action. While it has no direct effect on tuning, this feature enables you to use a high amount of reset action without the oscillation penalty usually encountered. Reset clip provides forced damping to prevent too much automatic reset whenever an overshoot condition exists. It does this by clipping the offset register for the internal setpoint proportionately to the value you select while tuning the controller.

A.3.3 Derivative Control

The final control action of a PID controller is D - the derivative factor, sometimes called "rate action" or "pre-act" (because it anticipates changes). In most controllers, derivative control initiates corrective action whenever the deviation changes. (If there is no change, there is no derivative action.) The amplitude of the response (correction) is proportional to how fast the deviation (input) is changing. This approach can result in excess correction when the setpoint is changed — the new setpoint represents a very fast change in deviation, and derivative action therefore dictates a large correction factor.

JCS controllers avoid such overreacting by using the rate of change of the actual process value as the basis (input) for calculating the correction. Changing the setpoint doesn't cause a derivative action response until the process variable begins to change. The net effect of this approach is a dynamic braking action — the controller's derivative action opposes a change in the actual process value. In this way, overly rapid responses can be slowed and a delayed system can be kept from overshooting the setpoint.

The typical application of derivative control is for a system with lengthy thermal delay. By the time the controller can respond to the actual process value, too much heat energy is stored in the system. The process value will overshoot the setpoint, then oscillate around the setpoint before stabilizing.

Figure A-8 shows how derivative action tends to dampen process value changes. Note that the amplitude of the derivative correction remains constant as long as the process value is changing at a constant rate. Also note that the amplitude of the derivative correction corresponds to the process value change rate.

Figure A-9 shows how the three factors — proportional, integral, and derivative — are independently derived, then summed to act upon controller output.

A.4 CHANGING CONTROLLER PID+ PARAMETERS

A.4.1 Accessing Tuning Screens

1. From the Stop screen, press PAGE DOWN to access the Main Menu.

NOTE

During tuning, you can press RESET at any time to immediately return to the Stop screen.

2. Press 4 to access the Config-Tune-Calib menu.
3. If the screen prompts for an access code, enter the code. If you do not know the code, contact your supervisor. If the code has been forgotten, make a note of the numbers that appear in the last field of line 4 and call JC Systems Customer Service at 1-800-444-9980. They can use those numbers to decrypt your access code.
4. When the Config-Tune-Calib menu appears, press 2 to select Config Controllers, then press 3 to select Tune Controllers.

A.4.2 Select Channel and Stage

The first screen you see after selecting Tune Controllers is a menu that allows you to choose the channel and stage you want to tune. Each channel has two independent sets of PID+ tuning parameters, Stage 1 and Stage 2.

Press the applicable number key to select the desired channel and stage. All remaining tuning screens will automatically be set to the same channel and stage. The channel menu will be displayed again when you have completed all tuning menus. You must return to this menu to select another channel or stage, then enter the desired parameters for that selection.

Set the values for all PID parameters for the selected channel and stage by pressing PAGE DOWN to move to the remaining screens in succession. If the parameter you want to adjust is not on the screen displayed, continue pressing PAGE DOWN to reach the desired tuning screen.

A.4.3 Exiting Tuning Mode

In Controller Tuning mode, there are three separate screens for Stage 1 of each channel and four for Stage 2. To exit, you can either press RESET, which will immediately return you to the STOP screen, or repeatedly press either PAGE UP or PAGE DOWN to return to either the Main Menu or the Stop screen.

A.5 SET CYCLE TIME AND PROPORTIONAL CONTROL

From the Tune Controllers menu, press the applicable number key to select the channel and stage you wish to tune. The page appears that provides for setting cycle time, proportional band, and proportional control. The selected channel and stage number appear in the first line of the display.

A.5.1 Set Cycle Time

The Model 620 regulates power for heating and cooling by turning outputs on and off. Cycle times for both heat (INC) and cool (DEC) can independently set from 2 to 15 seconds. The longest possible cycle time that produces a stable, controlled output should be used. Long cycle times extend the life of electromechanical devices such as relays and solenoids.

The cycle time includes both time off and on, and is regulated by proportional control (see Para. A.3.1). For example, with a deviation of 3° , a bandwidth of 6° , and a cycle time of 2 seconds (the factory setting), the output will be on for 50% of the time, or 1 second, and off for the remaining 50% of the time (1 second).

A.5.2 Set Proportional Action

Lines 3 and 4 of this screen enable you to set the heat (INC) and cool (DEC) parameters for the proportional band or gain. After reviewing the guidelines and procedures described below, move the cursor to the appropriate field and enter the desired value. Then press PAGE DOWN to continue tuning the selected channel.

A.5.2.1 Determine the Minimum Setting

The proportional gain (sensitivity) determines the propor tional bandwidth. The higher the proportional gain, the tighter the proportional bandwidth. Changing the value in either line will cause a corresponding change in the other line for the selected action (INC or DEC). In other words, if you change the INC proportional band on line 3, the INC gain on line 4 will adjust accordingly, or vice-versa.

Since you set the controller span when you configured the controller, the Model 620 knows that number and can calculate the proportional gain and bandwidth from the values you enter (or the factory settings). The formulas the Model 620 uses to derive those values are as follows:

Proportional Gain Setting =
Controller Span (degrees) divided by Bandwidth (degrees)

Restating the equation to calculate bandwidth:

Proportional Bandwidth =
Controller Span (degrees) divided by Proportional Gain Setting

For example, if the Model 620 controller's span (see definitions) is 415° , to achieve a bandwidth of 6° (the factory setting) for this system, set the proportional band to 6. The gain setting will change to 69. Expressed algebraically:

X = 415 divided by 6; X = 69

A.5.2.2 Considerations for Selecting Proportional Bandwidth

The proportional bandwidth should be as small as possible without causing oscillation. With a bandwidth of 0, proportional and integral actions of the Model 620 are disabled. The control action with 0 bandwidth is similar to the on/off control action of a bimetallic thermostat.

A.5.2.3 Disabling Proportional Action Around the Setpoint

The Model 620 offers an adjustable integral-derivative (ID) band that creates a zone between Heat and Cool proportioning where the proportional action is disabled. Refer to Para. A.7.3 below for more information.

A.6 SET RESET (INTEGRAL CONTROL) AND RESET WINDUP INHIBIT

Access this screen by pressing PAGE DOWN after you select proportional settings (Para. A.5).

A.6.1 Set Auto Reset

The Auto Reset field on line 2 of this screen regulates the I (integral) portion of PID control. The value selected determines the factor the controller uses to correct for deviation. If the reset value is too high, the derived (internal) setpoint overcorrects for the deviation and causes the process value to oscillate around the setpoint. If the reset value is too low, it will take too long for the process temperature to reach the setpoint. (See the discussion in Para. A.3.2.)

To set Auto Reset, move the cursor to the desired field (below INC or DEC) and enter the reset value. The available range is from 0.00 to 9.99 repeats per minute.

NOTE

You must press the decimal key before entering decimal values, or you will see the prompt, "NUMBER ENTERED WOULD BE TOO LARGE".

A.6.2 Set Reset Windup Inhibit

The RWI field on line 3 of this screen works with Auto Reset to limit the maximum error integrated and reduce instability around the setpoint. You can select a reset windup inhibit (RWI) percentage (of bandwidth) from 1 to 100%. (A setting of 0 defaults to 100%.) The RWI setting determines the maximum error in degrees that the controller will integrate as a function of time. The number of degrees is displayed in the corresponding RWI UNITS field of line 4. The value shown in the RWI UNITS field changes automatically as you adjust the RWI setting.

A.7 SET RESET CLIP, RATE (DERIVATIVE CONTROL), AND ID BAND

Access this screen by pressing PAGE DOWN after you select integral settings (Para. A.6).

A.7.1 Set Reset Clip Factor

Line 2 of this screen enables you to select a RESET CLIP factor ranging from 0 to 100%. If the process value (temperature or relative humidity) exceeds the setpoint by the selected ID Band value, the integral action (reset) overshoot is clipped by the specified Reset Clip %. Therefore, the system can rapidly settle to the final setpoint value. This does not directly affect PID parameters.

To set Reset Clip, move the cursor to the desired field (below INC or DEC) and enter the percentage factor to be used.

A.7.2 Set Rate

The RATE field setting on line 3 of this screen regulates the amplitude of the controller's derivative action response to changes in process temperature. The factory setting is 0.00 (rate disabled). To set Rate, move the cursor to the desired field (below INC or DEC) and enter a rate factor from 0.0 to 9.9.

NOTE

You must press the ./: key before entering decimal values, or you will see the prompt, "NUMBER ENTERED WOULD BE TOO LARGE".

A.7.3 Set ID Band (No Proportional Action Band)

The ID BAND field on line 4 of the display permits adjusting the integral-derivative band. This band creates a zone between Heat and Cool proportioning where the proportional action is disabled. The Integral and Derivative actions continue to function in the ID band. The value selected, which can range from 0.0 to 9.9 degrees or units, offsets the Heat proportional band *down* from the setpoint. It offsets the Cool proportional band *up* from the setpoint.

A small amount of ID band can be very helpful in adjusting operating parameters for a chamber system. A value of 0.5 is suggested.

NOTE

You must press the ./: key before entering decimal values, or you will see the prompt, "NUMBER ENTERED WOULD BE TOO LARGE".

A.8 SELECT STAGE 2 STATUS

Access this screen by pressing PAGE DOWN after you select rate settings (Para. A.7). It will display only when Stage 2 was selected for the channel being tuned.

This feature makes it possible to automatically switch to Stage 2 PID parameters by programming the appropriate event (G for Channel 1, H for Channel 2).

Press SEL to select whether this feature is ENABLED or DISABLED. When it is disabled, the related event — G or H — functions as a standard event output.

TABLE A-1. CONTROLLER PID TUNING SETTINGS

	CHANNEL 1, SET 1 INC	CHANNEL 1, SET 1 DEC		CHANNEL 2, SET 1 INC	CHANNEL 2, SET 1 DEC
CYCLE TIME:	_____	_____	CYCLE TIME:	_____	_____
Prop. Band:	_____	_____	Prop. Band:	_____	_____
Prop. Gain:	_____	_____	Prop. Gain:	_____	_____
Auto Reset:	_____	_____	Auto Reset:	_____	_____
RWI %	_____	_____	RWI %	_____	_____
RWI Units	_____	_____	RWI Units	_____	_____
Reset Clip%:	_____	_____	Reset Clip%:	_____	_____
Rate:	_____	_____	Rate:	_____	_____
ID Band:	_____	_____	ID Band:	_____	_____
Min_Output:	_____	_____	Min_Output:	_____	_____
Max_Output:	_____	_____	Max_Output:	_____	_____

	CHANNEL 1, SET 2 INC	CHANNEL 1, SET 2 DEC		CHANNEL 2, SET 2 INC	CHANNEL 2, SET 2 DEC
CYCLE TIME:	_____	_____	CYCLE TIME:	_____	_____
Prop. Band:	_____	_____	Prop. Band:	_____	_____
Prop. Gain:	_____	_____	Prop. Gain:	_____	_____
Auto Reset:	_____	_____	Auto Reset:	_____	_____
RWI %	_____	_____	RWI %	_____	_____
RWI Units	_____	_____	RWI Units	_____	_____
Reset Clip%:	_____	_____	Reset Clip%:	_____	_____
Rate:	_____	_____	Rate:	_____	_____
ID Band:	_____	_____	ID Band:	_____	_____
Min_Output:	_____	_____	Min_Output:	_____	_____
Max_Output:	_____	_____	Max_Output:	_____	_____

CH 1 P_Set 2: ___ Disabled ___ Enabled (Event G on)

CH 2 P_Set 2: ___ Disabled ___ Enabled (Event H on)

B. Program Worksheets

This appendix provides sample program worksheets that can be copied as many times as needed for your use. Two separate forms with slightly different headings are provided: one for use with the Model 620 as a single- or dual-channel standard programmer, and one for use with the Model 620 FastTRAC™ operating modes.

MODEL 620 PROGRAM WORKSHEET — FASTTRAC MODE

FASTTRAC MODE: STD ☐ PASSTHRU ☐ FASTTRAC TEMP. LIMITS: HI _____ LO _____

PROGRAM NO. _____ DATE _____

STEP	GUAR. SOAK		CHANNEL 1		THERMOBOOST		TIME			EVENTS								CYCLES/LOOPS/GOTO		
	GS1	GS2	SETPOINT	DEV. ALM +/-	HEAT	COOL	HH	MM	SS	1	2	3	4	5	6	7	8	PRGM	STEP	# OF TIMES
										A	B	C	D	E	F	G	H			

MODEL 620 PROGRAM WORKSHEET — SINGLE/DUAL-CHANNEL

NOTE: Clearing the setpoint disables the controller for that channel.

PROGRAM NO. _____ DATE _____

STEP	GUAR. SOAK		CHANNEL 1		CHANNEL 2		TIME			EVENTS								CYCLES/LOOPS/GOTO		
	GS1	GS2	SETPOINT	DEV. ALM +/-	SETPOINT	DEV. ALM +/-	HH	MM	SS	1 A	2 B	3 C	4 D	5 E	6 F	7 G	8 H	PRGM	STEP	# OF TIMES

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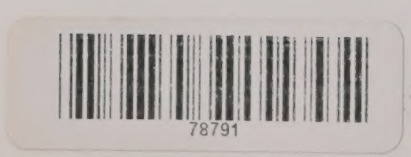
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